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THE FAILURE OF A WROUGHT-IRON STANDPIPE AT WATERLOO, N. Y., FROM PITTING.

By H. J. MORRISON,* M. Am. Soc. C. E.

The wrought-iron standpipe of the Waterloo Water Co., at Waterloo, N. Y., failed by bursting at 5.15 p. m., June 9, during a thunderstorm. A one-story brick building with 8-in. walls adjoining the pumping-station was practically destroyed by the rush of water, a large hole was washed in the ground near the base of the standpipe, and some damage was done to adjoining property by the water. The pumping station was uninjured. The lower 55 ft. of the standpipe remained standing, apparently uninjured by the bursting of the upper portion except possibly some slight leakage at the seams, which the superintendent for the company says is no more than before the accident.

This standpipe was erected in 1886 by a private company, and is still operated by such, but not by the original owners. It was 15 ft. in diameter and 130 ft. high, constructed in 5-ft. rings with all seams lapped, vertical seams double-riveted, and horizontal seams single-riveted. The top six rings were 3-16-in. plate, and the next five rings ¼-in. plate.

At the time of the failure the standpipe was said to be full of water, and the pumps were working.

An examination of the wrecked portion would indicate that the structure burst somewhere between the 12th and 16th rings, counting from the bottom, and upon the southwesterly side (see the ground-plan, Fig. 5 herewith). The 16th ring of plates was ruptured at one place, in a vertical line. This entire ring, with a small portion of the 15th and 17th rings attached, was doubled back upon itself with the outer faces together, and fell in a southwesterly direction from the standpipe into the hole in the ground made by the escaping water. The upper portion, consisting of the 17th and 26th rings, swung free from the standing portion of the standpipe, fell in a northwesterly direction and lies upon the ground a torn and flattened mass. The five rings at the top were not ruptured. The 12th, 13th, 14th and part of the 15th rings remained at the top of the standing portion, that at the northeast side in its original position with the other parts hanging from them.

The standpipe has been about 15 ins. out of plumb for the past 15 years, leaning towards the southwest. While this probably had nothing to do with the failure, it may have influenced the direction in which the upper portion fell.

Looking Southwest.

Looking Northeast.

Figs. 1 and 2. Lower Part of Standpipe After the Failure.

Diameter 15 ft. Original Height 130 ft. Rings 5 ft. wide. Rings 1-11 intact; rings 12-15 torn but still attached. The failure is thought to have centered in Ring 16.

Figs. 3 and 4. Pitting of Inner Face of Ring 16 and Bottom of Ring 17. View Taken in Neighborhood of Point Marked "C" in Fig. 5.

The spots seen on the plate are pits and grooves of local corrosion. Note the pitting of the rivet-heads in the horizontal seam between Rings 16 (at left) and 17 (at right).

FIGS. 1-4. THE WRECK OF THE WATERLOO STANDPIPE.

An examination of the interior surface of the plates of the fallen portion shows the 21st to 26th rings at the top to be free from pitting and practically in as good condition as new. The 18th, 19th and 20th rings show some pitting, the 16th and 17th rings considerable pitting; the 12th to 15th rings show a remarkable example of this action, and apparently, as near as can be ascertained from the ground, in vertical lines under each rivet head. This pitting of the plates was greatest in that portion of the tank which was constantly covered with water, and there was practically none where the plates were exposed part of the time to the air. There is no tuberculation.

On June 19 a strong wind brought down from the standing wreckage some loose plates that were part of ring 15. Fig. 11 is a photograph of one of these plates taken as it lay on the ground. It offers a remarkable picture of the regular and vertical grouping of the pitting.

The rivets joining the plates did not escape the pitting action, some of the heads being more than half eaten away. Many of these pit marks were bright, and many others that were not bright had apparently rusted since being exposed to the air. This would seem to indicate that the action upon the plates was electrolytic in its character.

An examination of the break in the 16th ring shows that it occurred about 4 ins. from a vertical seam, and along a vertical line of pitting. Fig. 6 shows how straight and vertical was the line of fracture. The plate was ¼-in. thick, and in several places the pitting extends to a depth of 3-16-in.; in general the thickness of the metal remaining along the line of rupture would not average more than 3-32-in.

In connection with the above, the writer, about five months ago saw water spurting through the plate near the point where the burst occurred, and was told by the superintendent that this leak was repaired by placing 5-in. x 15-in. plates one on the inside and one on the outside, and held in place by four bolts in a vertical row. These plates could not be found in the wreck, but it could be plainly seen where they had been attached near the bottom of the 16th ring, the line of rupture being directly through the vertical line of the bolt holes. It also indicated that the pitting at this place had extended entirely through the ¼-in. plate.

Pitting was active at the edges of the laps along the horizontal seams at the place indicated in the sketch (Fig. 10), and it was observed that several rings were torn apart along this

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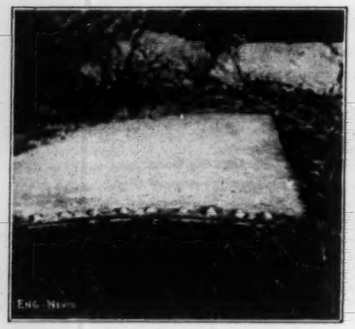
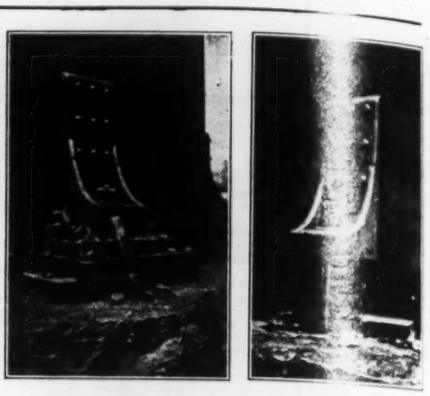


Fig. 6. View of Part of Ring 16, Showing Probable Point of Failure.

At front is horizontal seam. Right-hand edge is a straight vertical fracture; the plate had grooved along this line so much as to leak, and was patched some months ago. The break is through the patch bolt-holes.

FIG. 7. A TEAR NEAR THE HORIZONTAL JOINT BETWEEN RINGS 17 AND 18.

This point is nearly opposite where Ring 16 broke. The face turned up is the inner face of the plates; the torn edge is turned inward for the most part. Note the corrosion of the rivet-heads.



Figs. 8 and 9. Two of the Cast-Iron Foundation Brackets.

The one at left is broken clear through; broken anchor-bolts and units from other points are also shown here. The bracket in the right-hand view is No. 1 of Fig. 5; its brick pedestal is entirely destroyed. In both views the nut is clear of the bracket.

line. The writer understands that the interior of the standpipe has never been painted.

The pumping-station and the standpipe are located upon the bank of the Seneca River, from which the supply is obtained. The pipe supplying the village runs northerly from the standpipe about 700 ft. along Reed St. to Main St., then runs east along Main St. A trolley line traverses Main St., with its power station about ¼-mile west of the junction of Main and Reed Sts. There is no water main on Main St. towards the west, and it does not seem possible that stray currents from this line could have influenced the pitting action in the standpipe.

Fig. 10.

A sanitary analysis of the water of Seneca Lake, of which the Seneca River is the outlet, shows nothing unusual except that it is high in chlorine in the form of chlorides (52 parts per million). In this connection it is of interest that the adjoining village of Seneca Falls is supplied from Cayuga Lake with water very little different from Seneca Lake water except in chlorine (30 parts per million). The Seneca Falls Water Co. has a wrought-iron standpipe which has been in use about 20 years, and the writer is informed that very little pitting of the plates has occurred. The interior of this standpipe, however, has been painted several times.

Anchor bolts 1, 2 and 3 (see Fig. 5) on the side of the break were not broken, but the nuts are about ½ in. above the washers. Anchor bolts 4, 5 and 8 broke in the thread under the head of the nut; No. 7 broke in the rod 9 ins. below the nut, and at No. 6 the cast-iron lug attached to the tank cracked. The cross-section of the casting at the crack is 2 × 10 ins. The anchor bolts are 1½ ins. in diameter. The fractures show crystalline.

The fractures in the plates where torn diagonally show coarse, and are often laminated. Very few feet of the riveted seams failed. A few rivets were sheared, some pulled through the holes, and in a few places the plate tore apart along the rivet holes, but generally the riveting held and the plates tore.

As before stated, the failure occurred during a thunderstorm, and several people claim to have seen the standpipe struck by lightning. There is nothing about the wreck or in the vicinity, so far as the writer could find, that would substantiate this claim, but it is not impossible that the primary cause of the bursting was a shock from lightning striking the tank or in its vicinity.

The underlying cause of failure was undoubtedly the weakened condition of the plates due to the pitting action of the water. The condition of the interior was such that failure might have been expected at any time, although the superintendent told the writer that the workman making the patch about five months ago reported to him that the interior was in good condition.

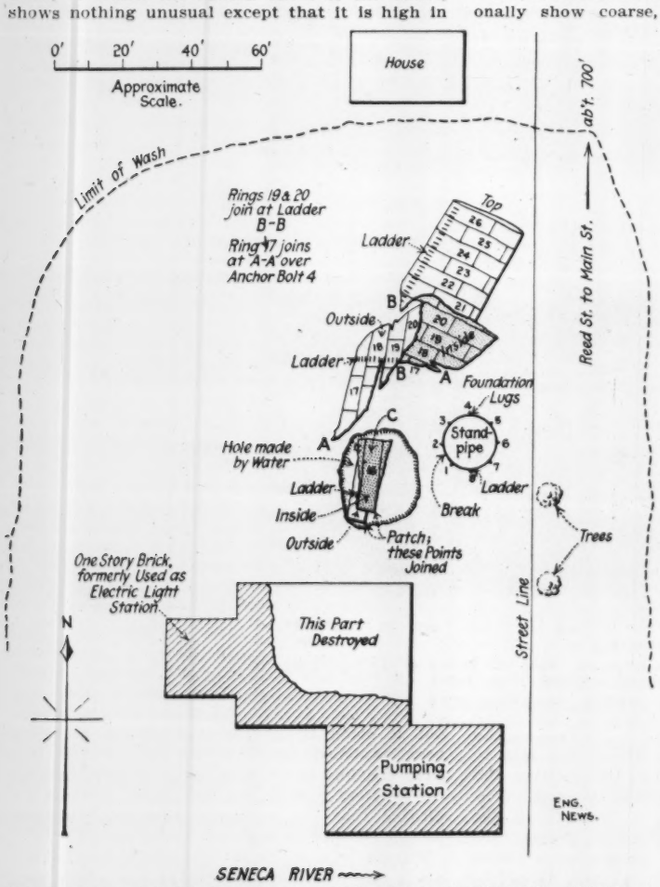


FIG. 5. PLAN OF STANDPIPE OF WATERLOO WATER CO., WATERLOO, N. Y., SHOWING SITUATION AFTER THE FAILURE.

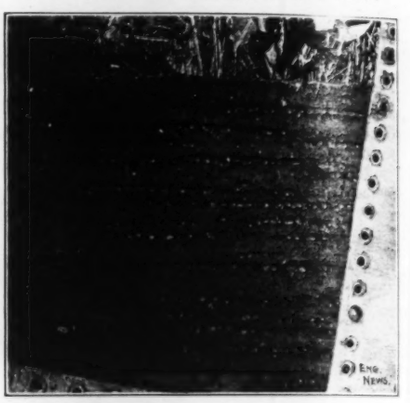


Fig. 11. Pitting on Inside of Ring 15, Showing Straight Vertical Lines of Pitting Under Rivets of Horizontal Joint.

(Plate at right shows outside face; plate at left is part of ring 15 and shows inner face.)

COMPARISON OF FORMULAS FOR COMPUTATION OF STREAM DISCHARGE.*

BY. J. C. STEVENS.†

To heap upon a carefully-made gaging the indignity of doubling its error in the computations would certainly be a ridiculous procedure, yet this is what actually may happen under certain conditions by the continual use of some of the formulas now in general favor. Again, under certain conditions all the formulas considered will give practically the same results, in which case the one involving a minimum amount of labor should by all means be adopted, and the more so when it is shown that the simplest has the least error under all conditions.

The following discussion has for its object the examination of several formulas for computing stream discharge, with a view to the adoption of one as a standard which will give reliable results under all field conditions.

The field notes of a gaging consist essentially of a series of depths and velocities usually measured at corresponding points and at equal intervals from a permanent initial point established on one bank of the stream.

To the present time, six different formulas have been generally used, arising from various assumptions as to the way in which depths and velocities vary from point to point. These may be generally classified as rectilinear and curvilinear formulas. In the curvilinear formulas the depths and velocities are considered in consecutive groups of three ordinates each, the depths and velocities being combined in a different manner for each formula, but all based on the assumption that the bed of the stream and the horizontal velocity curve consist of a series of parabolic arcs. In the rectilinear formulas ordinates are considered in groups of two or three under the assumption that the cross section of the stream and the horizontal velocity curve each describe the perimeter of a polygon.

STANDARD FORMULA.

For a basis of comparison it will be necessary to first develop an exact formula by which the accuracy of the several approximate formulas may be judged.

*A paper read before the conference of district engineers U. S. Geological Survey held at Washington, D. C., Jan. 20th to 25th, 1908.

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Let d_1, d_2, etc.....be the depths.
v_1, v_2, etc.....be velocities measured at corresponding points.
l =.....interval between points of measurement.

Now consider a single section of the stream of width l. On the assumption that the depth and velocity vary uniformly from d_1 to d_2 and from v_1 to v_2 respectively the depth at a distance x from one extremity of this section is

$$d_x = d_1 + (d_2 - d_1)\frac{x}{l},$$

and the corresponding velocity is

$$v_x = v_1 + (v_2 - v_1)\frac{x}{l}.$$

The elementary discharge is the product of these two expressions, and the total discharge of the section is

$$\int_0^l \left[d_1 + (d_2 - d_1)\frac{x}{l}\right]\left[v_1 + (v_2 - v_1)\frac{x}{l}\right] dx.$$

Integrating and reducing we obtain the standard formula

$$\frac{l}{6}[d_1 c_1 + (d_1 + d_2)(v_1 + v_2) + d_2 v_2].....A$$

Just what this formula expresses is best illustrated by considering the discharge as a volume generated by moving each particle of water down stream a distance equal to its velocity. Fig. 1 represents such a volume and it is seen that the total discharge is represented by the sum of the volumes of a number of prismoids each of length l having end areas d v. Strictly speaking the front face of such a volume is not composed of planes as represented, but is a surface of which vertical sections parallel with the thread of the current are vertical velocity curves. However, the velocity as here used will be taken to denote mean velocity in the vertical.

From the figure it will be seen that Formula A is simply the prismoidal formula applied to one of these prismoids in which the mid-area is obtained by averaging homologous dimensions of the end areas.

RECTILINEAR FORMULAS.

Four approximate formulas are considered under this caption, general expressions for which are:

$$l\left[\left(\frac{d_1 + d_2}{2}\right)\left(\frac{v_1 + v_2}{2}\right) + \left(\frac{d_2 + d_3}{2}\right)\left(\frac{v_2 + v_3}{2}\right) + \text{etc.}\right] B$$

$$2l\left[\left(\frac{d_1 + 2d_2 + d_3}{4}\right)\left(\frac{v_1 + 2v_2 + v_3}{4}\right) + ..\text{etc}..\right] C$$

$$l\left[\frac{d_1 v_1}{2} + d_2 v_2 + d_3 v_3 + ... \frac{d_n v_n}{2}\right] D$$

$$\frac{l}{8}\left[(d_1 + 6d_2 + d_3) v_2 + (d_2 + 6d_3 + d_4) v_3 + ..\text{etc.}\right] E$$

In Formula B a right prism of length l and cross-sectional area equal to the mid-area of the prismoid is substituted for each prismoid. Comparing it with Formula A we find for the difference between them,

$$\frac{l}{12}(d_1 - d_2)(v_1 - v_2).....(A-B)$$

This difference disappears for equality of either the depths or velocities and is seen to be positive as long as the two factors have the same sign; that is, as long as velocities increase or decrease with the depths. From our general knowledge we can safely say that unless locally disturbed this is the normal condition of flowing water. Hence it appears that Formula B will in general give too small results, although the disturbances which will reverse this condition are not uncommon.

In Formula C two consecutive prismoids are considered together and for their actual volume there is substituted a right prism of length $2l$ whose cross sectional area is the product of the averages of the homologous dimensions of the computed mid-areas of each prismoid. The difference between this formula and the standard is found to be

$$l\left[\frac{l}{12}(d_1 - d_2)(v_1 - v_2) + \frac{l}{12}(d_2 - d_3)(v_2 - v_3) + \frac{l}{8}(d_1 - d_3)(v_1 - v_3)\right].....(A-C)$$

This expression is positive under the normal conditions of stream flow as above defined. Under conditions when formula B gives too small results Formula C will give still smaller and under abnormal conditions where B would give too large results C will give still larger.

Moreover, it is seen that with this formula different results may be obtained from the same set of field notes, depending upon the order in which the ordinates are grouped. The total area in any manner of grouping will remain the same, but each partial area will be multiplied by a different velocity for each of the two possible ways of grouping, hence two different values for the discharge are possible from the same measurement. This difference in the gaging of Ashland Creek amounts to nearly 4%.

The use of Formula D is analogous to that of "averaging end areas" in earthwork computations. The difference between it and the standard formula is,

$$\frac{l}{6}(d_1 - d_2)(v_1 - v_2).....(D-A)$$

This difference is seen to be twice that between A and B and is of opposite sign. Hence under normal conditions Formula D will give too large results.

In Formula E each measured velocity is assumed to apply as a mean velocity to a partial area extending a distance ½l on either side of the point at which it is measured. It appears impossible to obtain a usable expression for the difference between this and the standard formula, and from the tables herewith it is seen to give too large or too small results indiscriminately. It is tedious to apply and therefore rarely used.

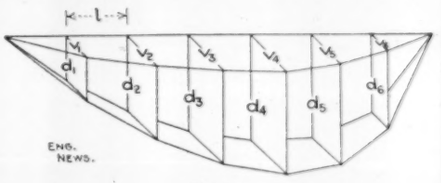


Fig. 1.

Diagram Illustrating Stream Discharge, Formula A.

CURVILINEAR FORMULAS.

In this class depths and velocities are assumed to vary along parabolic arcs. Two formulas are considered:

$$2l\left[\left(\frac{d_1 + 4d_2 + d_3}{6}\right)\left(\frac{v_1 + 4v_2 + v_3}{6}\right) + ...\text{etc.}\right] ..F$$

$$\frac{2l}{6}\left[(d_1 v_1 + 4d_2 v_2 + d_3 v_3) + ...\text{etc.}\right] ..G$$

Formula F is to-day largely used, but its relation to the actual volume of two consecutive prismoids in Fig. 1 is not easy to see. Still, by subtraction and reduction the following expression for the difference between it and the standard formula is obtained:

$$\frac{l}{18}\left[(d_1 - d_2)(v_1 - v_2) + (d_2 - d_3)(v_2 - v_3) + (d_1 - d_3)(v_1 - v_3) + 3(d_1 v_1 - 2d_2 v_2 + d_3 v_3)\right](A-F)$$

Formula G is generally known as the Harlacher method of computation. It considers a section of width $2l$ as a single prismoid, in which the measured area at the middle of this double section is assumed to be the mid-area of the prismoid. Or applied to a plane, it gives the area, by Simpson's ⅓ rule, of a figure bounded by the surface line and a curve, the ordinates to which are products of depth and velocity. The difference between it and the standard formula is,

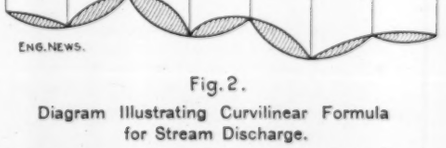


Fig. 2.

Diagram Illustrating Curvilinear Formula for Stream Discharge.

$$\frac{l}{6}\left[(d_1 - d_2)(v_1 - v_2) + (d_2 - d_3)(v_2 - v_3) - (d_1 v_1 - 2d_2 v_2 + d_3 v_3)\right].(G-A)$$

In both the above curvilinear Formulas F and G the ordinates are considered in consecutive groups of three each, and as the bounding curves are parabolic arcs it follows that, like Formula C, different results can be obtained from the same set of field notes, depending upon the manner of subdividing the cross section of the stream. The reason for this is apparent from Fig. 2. If the ordinates are taken in the order 1–2–3; 3–4–5; etc., a different result will be obtained than when they are taken in the order, 2–3–4; 4–5–6; etc. This is due to the fact that the curvature in the arcs is not only different in each case but is frequently entirely reversed.

If the depth curve and the horizontal-velocity curve were continually concave to the axis of reference there would be some justification in the use of a curvilinear formula. But this is seldom the case. The bed of a natural stream is nearly always an irregular curve, which produces corresponding irregularities in the horizontal-velocity curve. The extreme case is shown in Fig. 2, where alternate ordinates are longer than the intermediate ones, and the difference in areas is shaded. That this difference is by no means negligible in field practice is evidenced from the gagings of Big Butte and Ashland Creeks, where the differences for each of the Formulas F and G are over 7% in the one and nearly 11% in the other.

An analysis of the expressions for the differences between the standard and the approximate formulas will reveal certain comparable terms in each, by which their relative accuracy can be judged.

First consider a single prismoid (Fig. 1). If the difference between the two consecutive depths be multiplied by the difference between the corresponding velocities, having regard for the sign of each factor, we can represent the algebraic sum of these products for the entire cross-section of the stream by,

$$P = (d_1 - d_2)(v_1 - v_2) + (d_2 - d_3)(v_2 - v_3) + \text{etc.}$$

Next consider two adjacent prismoids. We can similarly represent the sum of the products of the difference between the extreme ordinates by

$$Q = (d_1 - d_3)(v_1 - v_3) + (d_2 - d_5)(v_2 - v_5) + \text{etc.}$$

Also denote the algebraic sum of the differences between the middle area and the average of the end areas in each double section by

$$R = \left(d_2 v_2 - \frac{d_1 v_1 + d_3 v_3}{2}\right) + \left(d_4 v_4 - \frac{d_3 v_3 + d_5 v_5}{2}\right) + \text{etc.}$$

We can then express the difference between the standard and the approximate formulas as follows:

$$(A-B) = \frac{l}{12}P$$

$$(A-C) = \frac{l}{12}P + \frac{l}{8}Q$$

$$(A-D) = -\frac{l}{6}P$$

$$(A-F) = \frac{l}{18}(P + Q - 3R)$$

$$(A-G) = -\frac{l}{6}(P + R)$$

Under normal conditions of stream flow, i. e., when changes in velocity concur with changes in depth, the quantities P and Q will always be positive, hence Formulas B and C normally give too small results. With Formula C, although different results are possible from the same set of field notes, as previously pointed out, each of these results will be too small. It furthermore appears that the range of error in C is much larger than in either B or D. In the case of the three-ordinate, curvilinear Formulas F and G the quantity R is involved which may be either positive or negative. In both these as with Formula C different groupings of the ordinates give different discharges for the same gaging, but the effect is intensified. The quantity R may be and usually is positive for one manner of grouping and negative for the other, while P and Q will retain the same sign in both. For continual concavity of both depth and horizontal-velocity curves Formulas F and G will give larger results than A, but for the irregular conditions usually encountered they will give too large results for one manner of grouping the ordinates, and too small for the other, while their range of error is quite large.

Considerable mention has been made of normal and abnormal conditions of flowing water. Normal condition has been defined as that wherein an increase in depth as we pass across the stream will be evidenced by a corresponding increase in velocity and vice versa. The truth of this statement hardly needs demonstration. A single hypothetical case will be given with results obtained from all formulas discussed.

For normal conditions let velocities and depths have the following numerical values:

$d_1 = 3.0$ ft.	$v_1 = 2.0$ ft. per sec.
$d_2 = 4.8$ ft.	$v_2 = 3.2$ ft. per sec.
$d_3 = 6.0$ ft.	$v_3 = 4.0$ ft. per sec.

For abnormal conditions, reverse the velocities.

$d_1 = 3.0$	$v_1 = 4.0$
$d_2 = 4.8$	$v_2 = 3.2$
$d_3 = 6.0$	$v_3 = 2.0$

let $l = 10$ ft. for both cases.

The results for both conditions are tabulated below:

Formula.	Normal conditions. Disch.	Normal conditions. Error. sec. ft.	Normal conditions. Error. %	Abnormal conditions. Disch.	Abnormal conditions. Error. sec. ft.	Abnormal conditions. Error. %
A	298.4	0	0	278.4	0	0
B	295.8	−2.6	−0.9	280.8	+2.4	+0.9
C	288.3	−10.1	−3.4	288.3	+9.9	+3.5
D	303.6	+5.2	+1.7	273.6	−4.8	−1.7
E	287.7	−10.7	−3.6	271.2	−7.2	−2.6
F	294.5	−3.9	−1.3	294.5	+16.1	+5.7
G	304.8	+6.4	+2.1	284.8	+6.4	+2.3

Note that the actual discharge for the two conditions differ by as much as 7%, yet Formulas *C* and *F* give the same results, respectively, for both cases, as might have been foreseen. The largest error occurs from the use of Formula *F* under abnormal conditions, being nearly 6%; the smallest by Formula *B* and the next by *D*, the errors for each condition being of opposite sign.

We now present some results from actual gagings in which an attempt has been made to choose measurements of type streams under ordinary conditions as found at many gaging sections. Results are given for the formulas discussed for six discharge measurements. For each of the three-ordinate formulas two cases are presented. Counting the water's edge "one," Case 1 groups the ordinates in the order 1—2—3; 3—4—5; etc. Case 2 groups them in the order 2—3—4; 4—5—6:

DESCHUTES RIVER, NEAR BIGGS, ORE.—This typifies a large stream under normal conditions of flow. The bed is of smooth gravel and the velocities are very uniform. The water surface was 450 ft. wide and observations of depth and velocity were taken every 10 ft. Depths averaged about 4 ft. and the mean velocity was 3.24 ft. per sec. Exceptionally favorable conditions were found here and it is seen that all formulas give results well within the limit of accuracy of the measurement itself.

Deschutes River, near Biggs, Oregon.
Gaging by Stevens and Oakes. Oct. 18, 1906

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	5286	0	0	....
B	5280	−6	−.1	....
C case 1	5197	−89	−1.6	1.1
case 2	5260	−26	−.5	
D	5298	−12	+.2	....
F case 1	5256	−30	−.6	.1
case 2	5282	−24	−.5	
G case 1	5304	+18	+.3	.1
case 2	5297	+11	+.2	

UMATILLA RIVER AT UMATILLA, ORE.—This is a stream of medium size, rather shallow, and water fairly swift. The bed is of solid rock, but worn quite smooth. The depths averaged 1.9 ft. and the mean velocity was 4.34 ft. per sec. The width was 176 ft. and observations were taken every 10 ft. Normal conditions generally obtain, although for about 15 ft. near the center of the stream where the depths were increasing the velocities were decreasing.

Umatilla River, at Umatilla, Ore.
Gaging by J. C. Stevens. April 19, 1906.

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	1427	0	0	....
B	1420	−7	−.5	....
C case 1	1416	−11	−.8	2.1
case 2	1387	−40	−2.8	
D	1441	+14	+1.0	....
E	1443	+16	+1.1	....
F case 1	1444	+17	+1.2	3.6
case 2	1393	−34	−2.4	
G case 1	1466	+39	+2.7	2.5
case 2	1430	+3	+.2	

NACHES RIVER, NEAR NORTH YAKIMA, WASH.—This was a low-water measurement of a rather large stream. The conditions were very favorable. The width was 42 ft. and observations were taken every 2 ft. The depths averaged 1.6 ft. and the mean velocity was 2.15 ft. per sec. The bed was of smooth gravel and the velocities very uniform. All results are well within the limit of accuracy of the measurement itself.

Naches River, near North Yakima, Wash.
Gaging by J. C. Stevens. Sept. 26,1907.

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	148.5	0	0	....
B	148.2	−.3	−.2	....
C case 1	147.2	−1.3	−.9	.1
case 2	147.4	−1.1	−.7	
D	149.1	+.6	+.4	....
E	149.0	+.5	+.3	....
F case 1	148.4	−.1	0	.5
case 2	147.7	−.8	−.5	
G case 1	149.3	+.8	+.5	.3
case 2	148.8	+.3	+.2	

BIG BUTTE CREEK, NEAR BUTTE FALLS, ORE.—This is a type of the mountain stream where smooth stretches of water are not plentiful. The bed at the point of measurement was composed of gravel and boulders. Velocities were somewhat disturbed by large boulders some distance upstream. The width was 47 ft. and observations were taken every 5 ft. The average depth was 2.6 ft. and the mean velocity was 1.80 ft. per sec. Note the large errors of Formulas *C*, *F* and *G*, also the difference of over 7% from the two cases of Formula *F*.

Big Butte Creek, near Butte Falls, Ore.
Gaging by Stevens and McGlashan. July 16, 1907.

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	218.8	0	0	....
B	216.9	−1.9	−.9	....
C case 1	211.4	−7.4	−3.4	1.6
case 2	214.7	−4.1	−1.9	
D	222.7	+3.9	+1.8	....
E	220.1	+1.3	+.6	....
F case 1	213.0	−5.8	−2.7	7.4
case 2	228.9	+10.1	+4.6	
G case 1	218.3	−.5	−.2	5.8
case 2	231.0	+12.2	+5.6	

SOUTH FORK OF ATANUM CREEK, AT TAMPICO, WASH.—This typifies the small stream with smooth bed and uniform velocities. The width was 10.5 ft.; the average depth was 0.9 ft. and observations were taken every foot. The average depth was 0.9 ft. and the mean velocity was 1.06 ft. per sec. The bed was of silt and very regular. All formulas give practically the same results.

South Fork of Atanum Creek, at Tampico, Wash.
Gaging by H. D. McGlashan. Aug. 27, 1907.

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	9.79	0	0	....
B	9.77	−.02	−.2	....
C case 1	9.67	−.12	−1.2	.5
case 2	9.72	−.07	−.7	
D	9.82	+.03	+.3	....
E	9.80	+.01	+.1	....
F case 1	9.84	+.05	+.5	.7
case 2	9.77	−.02	−.2	
G case 1	9.88	+.09	+.9	.6
case 2	9.96	−.03	−.3	

ASHLAND CREEK, AT ASHLAND, ORE.—This is a small stream with rough bed. At the gaging section the velocities were low. The width was 16 ft. and observations were taken every 2 ft. The depths averaged 1.2 ft. and the mean velocity was 0.48 ft. per sec. The bed was of gravel and cobblestones. The velocities were disturbed by boulders up-stream and there was some dead water at one bank. Note the excessively large errors for formulas *C*, *F* and *G*, and the big differences in the two cases for the same formula, 11% with *F*, nearly 10% with *G*, and 4% with *C*.

Ashland Creek, at Ashland, Ore.
Gaging by C. E. Ellsworth. Sept. 10, 1908.

Formula	Discharge.	Error. sec. ft.	Error. per cent.	Difference for same formula. per cent.
A	9.15	0	0	....
B	9.10	−.05	−.6	....
C case 1	8.75	−.40	−4.4	3.8
case 2	9.08	−.07	−.8	
D	9.26	+.11	+1.2	....
E	9.22	+.07	+.8	....
F case 1	8.68	−.47	−5.4	11.0
case 2	9.64	+.49	+5.4	
G case 1	8.91	−.24	−2.6	9.6
case 2	9.77	+.62	+6.8	

CONCLUSIONS.—An examination of the foregoing tables will reveal the following facts:

(1.) Under good conditions where the stream bed is smooth and regular, velocities uniform and not disturbed, all formulas give results well within the accuracy of measurements themselves.

(2) Under less favorable conditions, where velocities are disturbed, where the stream bed is rough (but perhaps the best site that can be found) *errors exceeding the probable error of the measurement may be introduced by the use of formulas C, F, and G*, all of which have been quite generally used.

(3) Formula *C* gives too small results for both cases in all the examples given as theoretical considerations show, and although in some the conditions were not "normal," yet the velocities were not sufficiently disturbed to make this formula give positive errors for the entire stream, although in certain portions of the cross-section in some of the examples this did actually happen. The largest single error for this formula was 4.4% occurring under Case 1 in the Ashland Creek gaging.

(4) Formula *F* with one exception, and *G* with two, gave too large results for one manner of grouping and too small for the other. The largest single error for *F* is 5.4% under Case 2 at Ashland Creek and for *G* is 6.8% for the same, while the errors in the B[illegible]utte Creek gaging for these formulas are nearly as [illegible]

(5) Formulas *B* and *D* for all the gag[illegible] give consistently the smallest errors, that of *D* b[illegible] twice that of *B* and of opposite sign throughout. errors are, however, well within the limit of accura[illegible] the measurements themselves, the largest being +1 for *D* and −.9% for *B* in the Big Butte Creek [illegible]. In the Ashland Creek gaging, where the errors [illegible] the other formulas were so large *B* and *D* gave −[illegible] and +1.2% respectively.

(6) When either of the three-ordinate [illegible]mulas are used, the manner of grouping the ordina[illegible] is entirely arbitrary with the person computing the [illegible]asurement. Two persons independently computing the [illegible] and Creek gaging by formula *F* might have both h[illegible] correct (?) results differing as much as 11%! For som[illegible] unaccountable reason this formula has been very [illegible]pular, yet there is no justification for its use as it [illegible]s a large range of error and is very tedious to apply.

(7) The standard Formula *A* can, wher[illegible] considerable refinement is required, be adapted to field [illegible]ice with no more labor than is now experienced wi[illegible]rmula *F*. It is seen to be

$$A = \frac{I}{3}(D + 2B)$$

Its use is, however, seldom required since either formula *B* or *D* will give results sufficiently accurate [illegible] all practical purposes.

(8) The extreme simplicity of Formula *D* [illegible]commends it for general use. Stated in words, it is: *multiply each depth by the corresponding velocity. Treat these products as ordinates to a curve and find the area under this curve by the trapezoidal rule.* It is well adapted to regular or irregular intervals between points of observation.

(9) Formula *B* has the least error of any under consideration, but requires two more columns in the notes than the use of *D*. In words it is: Average each depth with the one following and multiply this average by the mean of corresponding velocities. The sum of these products multiplied by the common interval is the discharge. If the interval is not common each product is to be multiplied by the respective width over which it applies, before the sum is taken.

(10) The use of formulas *C*, *E*, *F*, and *G* should be abolished at once, as they are not rational and have neither simplicity nor accuracy to recommend them.

A TWO-STAGE VACUUM PUMP capable of producing a vacuum within 0.02-in. of the barometric height has been developed by the Blake & Knowles Steam Pump Co., 115 Broadway, New York City, and is being used by makers of incandescent lamps and other concerns requiring high vacuum. The pump is of the reciprocating piston and cylinder type with two cylinders of 12 ins. diameter and 12 ins. stroke. The valves are operated mechanically from eccentrics on the main shaft. The machine may be driven by belt or gearing, or is built with steam cylinders attached.

THE COST OF TWO CONCRETE STRUCTURES on the Truckee Carson Irrigation system, built by force account between August and November, 1907, is given in the June "Reclamation Record." One of these structures is a waste-way, the other a drop with turnout on each side of the canal; in the latter about 200 lbs. of steel were used, the cost of which is in the table included in the cost of concrete. Wages for labor (excepting foremen), form a part of the unit and total costs as given in the table; they were, concrete men, $2.50; pavers, $2.75 per day; labor of foremen is included in the non-productive account. Concrete proportions were 1:2:4; the sand was hauled ¼ to ½ mile, crushed rock, 7 to 8 miles; cement, 10 to 11 miles. A 6-in. layer of stone upon a foundation of 4-ins. of crushed rock, all interstices filled with crushed rock, forms the pavement of which 21 sq. yds. were grouted for the waste-way and 26 sq. yds. for the turnout. Cost of this grouting is included in total costs of paving. The riprap consists of a 6-in. layer of stone placed roughly along the canal banks. The costs of the separate structures are given as follows:

Class of work.	Unit.	Turnout. Quantity.	Turnout. Unit cost.	Turnout. Total.	Wasteway. Quantity.	Wasteway. Unit cost.	Wasteway. Total.
Trench excavation	Cu. yds.	43.0	$1.84	$79.17	40.6	$1.29	$52.04
Concrete	Cu. yds.	32.0	12.39	396.44	34.0	14.08	478.82
Forms (per cu. yds. concrete)	Cu. yds.	32.0	5.26	168.38	34.0	3.22	109.61
Placing forms	Ft. B.M.	4,016.0	25.41	....	3,170.0	21.84	....
Paving	Sq. yds.	180.5	2.88	520.37	174.0	2.69	467.86
Riprap	Sq. yds.	18.0	.72	12.91	47.0	.68	31.85
Backfill	Cu. yds.	40.0	1.00	29.99	40.0	.75	30.20
Flashboards	.....	27	...	15.07	12	..	19.34
Cast-iron guides	.....	8	...	108.08	4	..	18.90
Angles	.....	2	...	5.02	..	..	....
Total productive cost				$1,345.43			$1,208.62
Construction survey				15.34			13.96
Non-productive account				226.52			211.32
General expense				278.66			155.22
Total costs				$1,865.95			$1,589.12

SEWAGE PURIFICATION WORKS OF THE STATE AGRICULTURAL SCHOOL, ST. ANTHONY PARK, MINN.

By FREDERICK H. BASS.*

The State Agricultural School of Minnesota is situated about midway between the Twin Cities of St. Paul and Minneapolis. It has a winter population of slightly over nine hundred; of these one-half reside on the campus.

The sewerage system is for domestic sewage only. The old set of sewer pipes, which was the result of some twelve years of patchwork, and which carried both domestic and storm sewage, has been disconnected from the twenty buildings and now serves as a storm sewer only. Frequent stoppages of this sewer had made the need of a new sanitary system felt; the need was also emphasized by the offense due to the putrefaction of the sewage collected in low ground near the outlet. The city sewer was nearly three miles distant, so a disposal plant was decided upon. The fact that the place of disposal is adjacent to the State Fair Grounds, where once a year 300,000 people congregate, including the principal municipal officials of the state, gives an educational as well as practical value to the plant.

It was estimated by the engineer of the power plant that the maximum daily pumpage in the winter time was less than 50,000 gals. As the time of this estimate, previous to designing, was in June, the vacation season, no other way was open to determine the volume of sewage to be dealt with. The automatic recorder now installed in the septic tank dosing chamber shows from 70,000 to 85,000 gals. daily. The summer flow is about one-fourth of this amount. No water was encountered in the trenches during construction, so that in all probability ground water does not enter the sewers. The flow during the day is at a rate of from 1.5 to 2.0 times that of the night flow. Probably there are many leaky fixtures in the buildings. The results of purification are nevertheless good.

The sewage is contributed from barns, a slaughter house, a creamery and one or two small laboratories, as well as from dormitories, kitchens and so forth. The main chemical laboratory was connected to the storm sewer, it being thought that discharges from it might often interfere with the bacteriological action of the disposal plant.

The plant is compactly arranged, and consists of a septic tank, a percolating filter, a settling tank, and a sand filter, which receive sewage by gravity in the order named. It is within a short distance of the buildings served by the sewerage system.

Fig. 1 shows, approximately, the construction of the tank. A few changes were made in matters of detail. The time allowable for designing and drawing plans for the disposal system was eight days, so that some of the details were worked out as the construction progressed. The transverse cross-section of this tank is patterned after the design of A. Marston, for a tank built at Fairmont, Minn. In the opinion of the writer, after having built this tank, a simpler construction, allowing less complicated forms, would be less expensive for the average small municipality, especially if the grade of labor obtainable were poor. The tank is divided longitudinally on the third line, the capacity of the larger tank being from 36,000 to 48,000 gals., depending upon the elevation of the weirs. The smaller tank is of one-half this capacity. The dosing chamber has a capacity of 3,900 gals. It is operated by means of 12-in. alternating siphons, through 12-in. wooden troughs of square cross section, which discharge onto the two percolating filters.

There are no concrete baffles in the septic tank. It was the plan of the designer to experiment with baffles to determine their effect upon the distribution of flow. The funnel shape of the tank was expected to help in the distribution. It has been determined by experiment that in this tank baffles are necessary.

The percolating filters (Figs. 2 and 3) are each 60 × 24 ft. in plan. One is of broken stone, 1 to 2½ ins. in diameter, and the other of screened gravel of the same diameter. The upper foot of the 6 ft. of depth of one is of screened gravel from ¼ to 1 in. diameter. The distributing troughs are suspended from the roof of the housing 3 ft. above the surface of the filter. These and the lateral troughs of 6 ins. diameter are perforated at 5-ft. intervals with 1¼-in. holes, through which the sewage falls 2½ ft. onto splashers of the type used at the Experiment Station of the Massachusetts Institute of Technology. [See Eng. News, Jan. 9, 1908. —Ed.] It was the original intention to use wrought-iron pipe with sprinklers of the Columbus type [see article just mentioned—Ed.] but the delay in obtaining these and the facility of making the splashers decided the question. The wooden troughs and wooden splashers were also less expensive. The 6-in. concrete floor of these filters is covered by 12-in. split tile, raised from the floor by brick, as shown. The dose is ap-

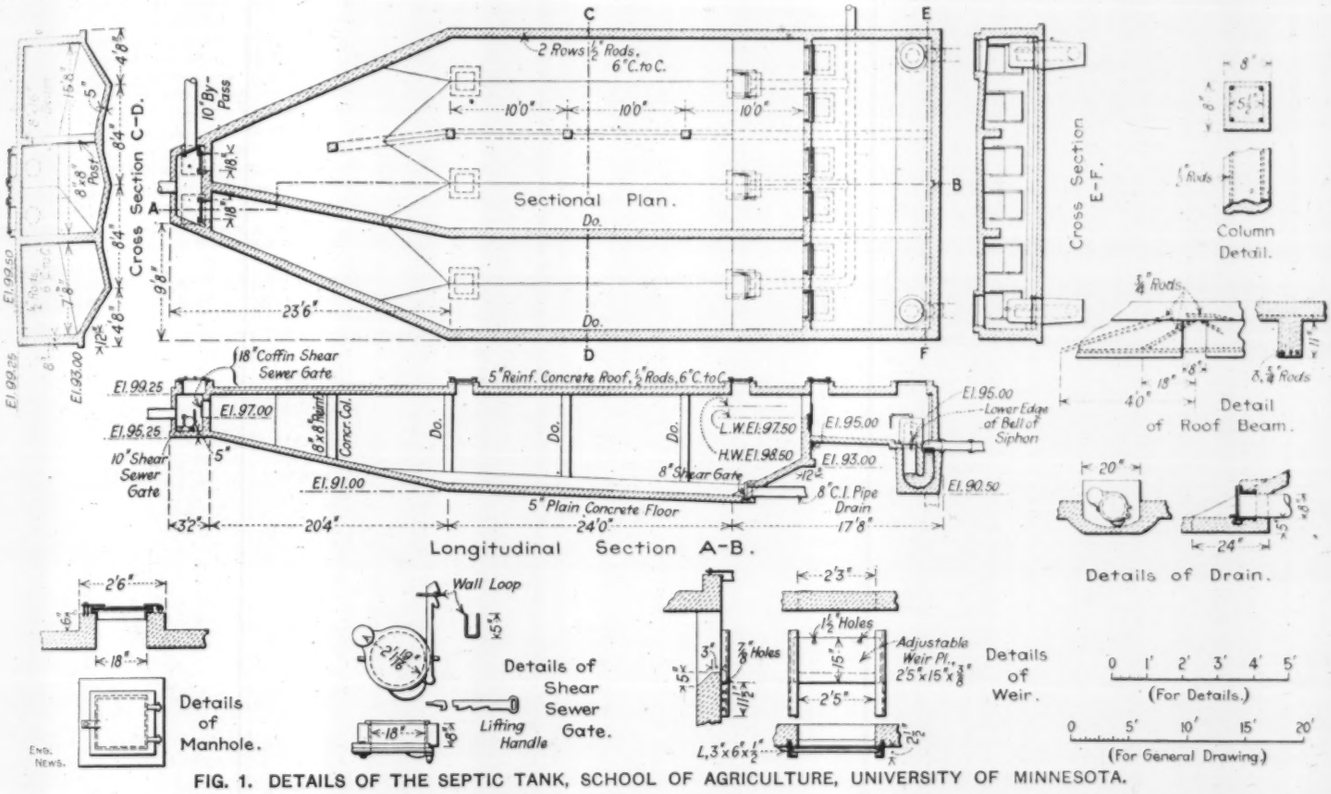


FIG. 1. DETAILS OF THE SEPTIC TANK, SCHOOL OF AGRICULTURE, UNIVERSITY OF MINNESOTA.

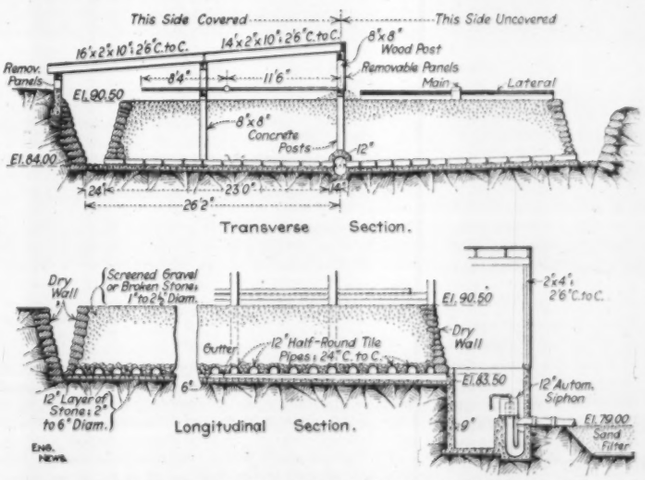


FIG. 2. SECTIONS THROUGH PERCOLATING FILTERS, SCHOOL OF AGRICULTURE, UNIVERSITY OF MINNESOTA.

*Engineer, Minnesota State Board of Health, University of Minnesota, Minneapolis, Minn.

plied within a time of three minutes and practically all of it drains through in about twenty minutes.

The settling chamber (Fig. 2) which receives the effluent from the percolating filters is emptied of the upper 4 ft. of its contents, upon the sand filters, by means of two 12-in. automatic Miller siphons at the rate of 7,800 gals. per dose.

Each sand filter (Fig. 4) is 2¾ ft. in depth and 30 × 80 ft. in plan. The sand filters are furrowed in ridges for the winter and have given no trouble from freezing. There has been some trouble from the formation of an exceedingly thin scum on the surface of these filters, but the scum is easily removed by surface raking. The scum is probably caused by fats from the creamery; this will be determined, as well as other points of interest in the working.

The sewage is applied to the sand filters by means of two lines of 12-in. sewer pipe, provided with 4-in. double Ts, 8 ft. c. to c., shown in Fig. 4. Each of the sand beds is underdrained by four lines of 6-in. drain tile.

The plant is the subject of study by Mr. John Wilson, a graduate student of the College of Engineering of the University. Mr. Wilson was resident engineer of construction and his painstaking efforts have largely contributed to the successful completion and operation of the plant thus far.

The reduction of bacteria is from 90 to 99.8%; of oxygen consumed, 90%; of organic nitrogen, 94%. The effluent stored in light and at 70° F. for three days in closed bottles gives no odor. The turbidity of the raw sewage is 220, silica standard; of the effluent of the percolating filter, 120; of the effluent of the sand filter, 5.

The actual cost of the whole sewerage system was about $9,000, and of the disposal plant, alone, about $5,000. The writer was engineer for the whole work.

FIG. 3. SIDE VIEW OF PERCOLATING FILTERS BEFORE THEY WERE COVERED.

FIG. 4. SAND FILTERS, SHOWING ALSO HOUSING OF PERCOLATING FILTERS IN THE BACKGROUND.

A REPORT ON STREET LIGHTING IN ST. LOUIS.

An association of citizens in St. Louis, known as the Civic League, more than a year ago appointed a special committee to report on the best method of street lighting for the city to adopt. The committee was made up as follows: Prof. J. L. Van Ornum, Chairman, Head of the Civil Engineering Department of Washington University; E. L. Adreon, Vice-President and General Manager of the American Brake Co., who for eight years served as Comptroller of St. Louis; Joseph D. Bascom, of the Broderick & Bascom Rope Co.; Trescott F. Chaplin, attorney; John J. Lichter, mechanical engineer; A. S. Langsdorf, Head of the Electrical Engineering Department of Washington University.

This committee has just submitted its report, which has been published in an illustrated pamphlet of 44 pages. The report is an exhaustive review of the art of street lighting and should be in the possession of any engineer interested in this department of municipal work. Copies can be obtained, we presume, by addressing Mr. Mayo Fesler, Secretary Civic League of St. Louis, St. Louis, Mo.

Our own space permits us to present only the summary of the Committee's recommendations, which is as follows:

I. The present contracts for street lighting expire August 31, 1910.

II. Definite arrangements for the lighting of the streets should be made far enough in advance of that date to secure the best system of lighting and insure the best terms to the city.

III. The committee believes that for the present at least the residential section of the city should be lighted by gas and the business section by electricity.

IV. The present cost of electricity of $97.50 per arc lamp per year and $19.65 per incandescent lamp per year, and of gas at approximately $27 per mantle lamp per year, is unreasonably high and should be materially reduced.

V. Three possible ways of securing a reduction in the cost of electricity:

A. By constructing a municipal plant.

B. By encouraging competition.

C. By regulating and controlling prices.

A. A Municipal Plant:

1. The total cost of operating a municipal plant if operated in a business-like manner, would be approximately 2½ cts. per KW.-hr., or about $69 per arc lamp per year, and about $17 per incandescent lamp per year.

2. But the danger of partisan politics in the management and operation of the plant, which tends to reduce its efficiency and increase its cost, indicates the inadvisability of municipal ownership except as a last resort.

3. Municipal ownership in the place of public franchise grants merely transfers the danger of political mismanagement from the legislative body, which grants the franchise, to the administrative officials appointed by the legislative body to operate the plant.

4. The economy of municipal operation and control has not yet been proven in this country—only two of the first ten cities, Chicago and Detroit, have attempted it. The experience of these two cities is not such as to warrant the statement that a municipal plant would be more economical than contract lighting.

5. In the opinion of the Committee the conditions at the present time are unfavorable for the construction and operation of a municipal electric lighting plant for the lighting of the streets of the city; and it believes this function should not be undertaken by the municipality if reasonable rates and efficient service can be secured from private companies. However, the city should reserve the right to construct its own plant.

B. Competition:

1. The duplication of investment and equipment, the damage to the pavement, and the injury to the appearance of the city, make competition wasteful, ultimately add to the price paid by the consumer, and finally induce public lighting corporations to merge.

2. The company which supplies commercial lighting can supply public lighting at a minimum cost to the city, because:

(a) Every increase in the demand for service means a decrease in the cost of production.

(b) An electrical plant, primarily for street lighting, cannot be operated economically since its daily output is small and it is under full load for less than half the time. A commercial plant is under a more nearly uniform load during the twenty-four hours of the day.

(c) A private company can take immediate advantage of inventions and improvements for reducing the cost of production. Municipal plants, as is shown by experience, seldom keep pace with modern and improved methods.

3. Your committee is of the opinion that a resort to competition, while it might assist in reducing exorbitant rates temporarily, is only a makeshift, and that permanently satisfactory results and a minimum cost for lighting cannot be secured by competition.

C. Regulation and Control of Existing and Future Companies:

1. The Enabling Act of 1907 gives the city full power and authority to fix and determine reasonable rate both for gas and electricity, and to provide and enforce fines for the violation thereof.

2. A Public Utilities Commission, composed of competent and trustworthy business and technical men, should be provided immediately by ordinance, with such powers as are prescribed by the Enabling Act.

VI. Payment for electricity and gas should be based upon metered service—the maximum cost per lamp per year being fixed by ordinance.

VII. No contract should be made for gas or electric lighting covering a long period of years, and it should contain provisions for frequent readjustment of rates and a clause enabling the city at intervals to require the substitution of new and more efficient styles of lamps. Only in this way can the public reap the advantage of the rapid reduction being made in the cost of gas and electric light as a result of new inventions and improvements.

VIII. A uniform system of efficient and ornamental lighting should be established, especially for the business streets of the city.

(a) In the business portion electroliers or arc lamps of uniform style should be adopted and so spaced as to brilliantly illuminate the streets by night and make them attractive by day.

(b) In the residential portion it may be deemed advisable to supplement the present gas lights with arc lights at street intersections in order to secure adequate illumination.

IX. In all of the conclusions reached, the committee is unanimously of the opinion that a definite and reasonable regulation and control of prices and service, determined by a Public Utilities Commission, permanently established by ordinance under recent statute, is fundamentally essential.

FREIGHT HANDLING AND CONVEYING MACHINERY in railway warehouses and freight houses and at steamship piers is being made a subject of inquiry by the Yards and Terminals Committee of the American Railway Engineering and Maintenance-of-Way Association. The committee's report on this subject, as presented at the annual convention, was published in our issue of March 26, 1908, but the committee is now continuing the investigation. There are as yet very few installations of this kind, one objection to them being the great variety of size, shape and weight of the packages to be handled, and the difficulty of adapting a conveyor to suit all these varieties. On the other hand, the saving in time and labor by the use of mechanical conveyors instead of the ordinary system of hand trucking might be considerable in a long freight house or pier shed where great quantities of material have to be handled. Information as to freight-handling installations is desired by the committee, and may be sent to E. H. Fritch, Monadnock Block, Chicago.

ANNUAL ADDRESS OF THE PRESIDENT OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.*

By CHARLES MACDONALD, President, Am. Soc. C. E.†

Twenty-two years ago the American Society of Civil Engineers held a convention in this city upon the joint invitation of their Denver brethren, the Denver Chamber of Commerce, and His Excellency, Governor Evans, of Colorado. The recollection of that memorable occasion has remained so fresh as to have inspired the desire to repeat the visit in order that we may more fully appreciate the tremendous strides that have been made in this brief interval of 22 years. Denver was young in 1885—with scarcely 65,000 people all told, but with evidences of power and potency which gave promise of greater things to come, and these are the things which we are now permitted to examine for ourselves, and to offer our congratulations on the wonderful results accomplished.

To mention but a few of them: the population has increased three-fold in 22 years; the assessed value of property, which was $30,610,330 in 1886, is $122,585,925 today; and the best evidence of prosperity is to be noted in the increase in bank deposits from $9,000,000 to $40,000,000. It would be foreign to our purpose to enlarge upon the records of progress everywhere in evidence; suffice it to say, that the controlling reason which induces the society to meet in convention annually in different parts of the country is to present object lessons such as this to its membership in order that as an organization it may be kept fully abreast of the times.

An examination of our own rate of progress during the past 22 years furnishes gratifying evidence of the success of the policy pursued by the management of the Society.

In 1886, the total membership was 925, of which there were but six in the entire state of Colorado, while at present the membership is upwards of 4,600, of whom 40 are residents of this State, 19 being located in the city of Denver.

The Society first began the publication of papers in 1867, but it was not until November, 1873, that regular monthly publications were issued. The current volume of "Transactions" completes the 66th volume of a library which is second to none in professional interest, a result which is largely due to the untiring energy and administrative ability of our Secretary, Mr. Chas. Warren Hunt.

FUNCTION OF THE ENGINEER.

The question naturally arises, what have engineers done since 1886 which is of special signification? Perhaps the most important result of engineering activity is the increase in railway mileage from 137,615 to 235,409 in the United States alone. When it is considered that the total mileage of railroads in the world at the present time is approximately 570,000, the proportion constructed by American engineers is, to say the least, creditable. The result of this enormous increase in facilities for internal communication has developed problems in Interstate Commerce which have put a strain upon the Constitution of the United States itself, as well as upon those of the several States, which bids fair to approach almost up to the elastic limit.

To construct a railroad involves a knowledge of Nature's laws. It is an exact science, and the result should insure the development of traffic upon lines of least resistance, and, consequently, at the least cost; but judging from the experiences through which we are passing, the problems of utilizing these mighty engines in developing the resources of the country through which they pass, have not been treated with that due regard for the immutability of natural law that has characterized the work of the engineer.

Conflicts have arisen between the sovereigns by whom powers were granted to construct the properties, and the managers of these properties, as to the right to fix rates of transportation upon them, resulting in a serious paralysis of business throughout the country, which, for the time being, threatens to retard further development until these differences are settled upon some equitable basis.

A careful examination of the methods employed in fixing traffic rates must convince liberal observers that no general principle of law has obtained. Traffic managers have too often been governed by their individual opinions as to what the rate should be, and the amount of business they could secure, irrespective of the interests of the people as a whole from whom they originally derived the right to fix any rate. The result has been, as might have been expected, discrimination favoring certain localities and individual shippers, which has aroused the whole country to the necessity of framing such laws as will protect the rights of all the people in the use of the franchises which have been granted by their representatives.

It has been said that the construction of a railway is an exact science, and while it cannot be claimed with equal propriety that the management of it can be formulated on equally exact lines, it is nevertheless the duty of those in control to investigate the general principles involved, which, if applied, will result in establishing harmony where now deplorable conflict exists.

In this connection, what is the function of the engineer? Heretofore, with few exceptions, he has been content to fulfill the duty of executive officer merely, in obedience to instructions from the financial interests controlling, without regard to questions of political economy involved in subsequent management.

This is not the highest ideal to which he should attain. To be an engineer of material only is to be but a subordinate element in a profession which has contributed, and will continue to contribute, more to the advancement of civilization than all others combined. Rather should he strive to become an engineer of men, pointing out lines of activity, based upon scientific principles, which permit of no discriminations or unfair advantages to favored interests. There should be no guess-work in his study of problems of transportation, but he should have ever before him the example of such men as the late Albert Fink, Past-President, Am. Soc. C. E., who as early as 1874 was able to evolve a system for the management of traffic in this country, which, if it could have been crystallized into the law of the land, would have been hailed by all parties in interest as an equitable deliverance from such disastrous complications as now beset us.

Again, in the management of employees, the engineer is best equipped by education and experience for settling differences between employer and employed. A single instance will suffice to illustrate. A recent predecessor of mine, then an officer of one of the most important trunk lines in the country, was called upon by the representatives of the Boilermakers' Union on the line of his road, who, with imperious swagger, demanded an immediate advance in wages. There was to be no discussion of the subject, and unless their demands were acceded to a strike would follow. It is needless to refer to what actually did follow, but the result was that every one of those men who came with blood in his eye, departed with the humble request that they might be permitted to shake the hand of a gentleman.

We must evolve more men of the type above referred to if we would render the best account of our stewardship.

CONSERVATION OF NATURAL RESOURCES.

The late Lord Kelvin, when in this country some years ago for the purpose of advising as to the best means of utilizing the water power at Niagara, was asked what effect the withdrawal of so much water from the Falls would have upon the natural beauty of the cataract. His reply was that of the true engineer: "What has that got to do with it? I consider it almost an international crime that so much energy has been allowed to go to waste."

A similar question arose in connection with the construction of the dam across the Nile at Assouan. Archæologists all over the world raised a protest against the project, because, forsooth, the ruins of the Temple of Philæ would be submerged for six months in the year. I venture to say that of all the visitors to Egypt not one in a thousand but would far rather inspect the graceful lines of that superb work, and picture to themselves the inestimable benefits accruing to the hundreds of thousands of tillers of the soil in the valley below, than gaze for a few passing moments upon the crumbling remains of a Grecian temple two thousand years old. Engineers will naturally consign all such archaic questions to the oblivion of the past, and concern themselves with that which confers the greatest good upon the greatest number. This line of thought naturally leads to the consideration of a subject which is attracting special attention at this time.

The President of the United States, in a letter dated Jan. 14, 1908, invited John Hays Hammond, President, American Institute of Mining Engineers; Minard Lafever Holman, President, American Society of Mechanical Engineers; Henry Gordon Stott, President, American Institute of Electrical Engineers, and the speaker, to attend a conference of the Governors of the several States, with their experts, to be held at the White House, May 13-15, for the purpose of considering the question of the Conservation of the Natural Resources of the Country.

At this conference these four presidents of engineering societies, representing approximately 20,000 American engineers, recommended the following resolutions for adoption by the conference:

Resolved: 1. That this conference places on record its conviction that to conserve and protect from waste and destruction the natural wealth of the United States in mines, forests, lands, and waters is of vital necessity to the public welfare. Action in this matter has been too long delayed, and vast loss has resulted in consequence, notably in the destruction wrought by forest fires, by floods, and the ruin of lands whose fertility and crop-bearing power has been lost. This unfortunate destruction of part of the natural wealth with which this virgin continent was originally stored makes it all the more necessary that wise action be taken to check further loss.

2. Though it recognizes the imperative need for prompt action, this conference is impressed with the difficulty of framing legislative acts which shall result in the largest measure of public benefit. The problems presented are many of them new and unprecedented. It is probable that action by both the Federal Government and the individual States will be essential, and it may also be possible by suitable laws to enlist the aid of private enterprise. But to decide upon the proper distribution of responsibility and to frame laws which shall not work injury as well as benefit is a matter demanding most careful study and investigation by men of high standing and expert qualifications.

3. While certain individual measures may be already in such shape that action upon them may wisely be taken, this conference holds that for the guidance of legislators, both State and Federal, a thorough investigation and study should be made by National and State Commissions so constituted that their conclusions and recommendations will be everywhere recognized as authoritative and made solely in the public interest.

4. This conference, therefore, urges upon Congress and the State Legislatures the enactment of laws authorizing the President and the Governors, respectively, to create National and State Commissions to investigate and report upon what measures should be taken to conserve the National and State natural resources.

These commissions should report at the earliest possible date consistent with the thorough performance of their work, in order to enable the President and the Governors to transmit with recommendations their reports to Congress and the State Legislatures for such action as may seem advisable to protect our natural resources from further spoliation and destruction, and to secure such economy in their use as will preserve for coming generations the foundations of prosperity.

5. In order to insure the harmonious cooperation of all the Commissions, this conference requests the President to call another National Conference at such time as may seem most advisable.

6. To secure the most efficient organization for handling the National problems which the reports of these Commissions will inevitably raise, the conference recommends for the consideration of the President and Congress the formation of a Department of Public Works to which these and other engineering matters could be referred, and to which the State Commissions could apply for information and assistance.

These resolutions were duly referred to the Committee on Resolutions of the Conference, and were favorably received by that body.

It will be observed that the crux of the recommendations rests in Clause 6—advising the formation of a Department of Public Works, which would naturally include under its jurisdiction all works of Public Utility classed under the heads of Improvement of Waterways and Harbors, Irrigation, Hydraulic Development, Drainage, etc., now distributed through the Departments of War, Interior, Agriculture, and Commerce and Labor.

At the time it was written, we were not aware that a bill had already been introduced by the Hon. J. E. Ransdell, of Louisiana, having this very object in view, and that in his introductory speech very powerful arguments had been given in favor of its passage. It was scarcely to be expected that this bill could be passed at this session, but members are earnestly requested to read carefully the arguments of the honorable gentleman from Louisiana, and if consistent with their own views, to urge upon their representatives the passage of such a bill. The general result of the conference has been to arouse public interest as it never has been aroused before, and it is to be hoped that the engineers of the country will realize their opportunity to exert a potent influence in framing such legislation as may best be suited to the accomplishment of the desired ends.

AGRICULTURE.

Having become a farmer myself, it may perhaps be permissible to refer to the possibilities of adding a new qualifying adjective to the subdivisions of the profession. If it can be proved that two blades of grass can be grown where one has heretofore been found to be the limit, it is certain that the sources of power in nature have been scientifically utilized, and the general wealth of the country correspondingly increased. This of a surety can be accomplished if the engineer will but turn his attention to agriculture as an adjunct to the creative work with which he has become familiar in the construction of lines of transportation, irrigation and drainage.

Quoting from the admirable paper read before the recent conference at Washington by James J. Hill, F. Am. Soc. C. E.:

In no other important country in the world, with the exception of Russia, is the industry that must be the foundation of every State at so low an ebb as in our own * * *. Our soil, once the envy of every other country, gave an average yield for the whole United States, during the ten years beginning with 1896, of 13.5 bushels of wheat per acre. Austria and Hungary each produced over 17 bushels per acre, France 19.8, Germany 27.6, and the United Kingdom 32.2 bushels per acre.

This is an appalling statement which, unfortunately, cannot be controverted, but the explanation is simple, and the remedy easily obtainable. We have been single cropping our soils until they have become unsanitary, and we have failed to make use of suitable methods of cultivation. In corroboration of this, I quote again from Mr. Hill's paper:

At the experiment station of the Agricultural College of the University of Minnesota, they have maintained 44 plots of ground, adjoining one another, and as nearly identical in soil, cultivation and care as scientific handling can make them. On these have been tried, and compared, different methods of crop rotation and fertilization together with single cropping. The results of

*Delivered at the 40th annual convention, Denver, Colo., June 23, 1908.

†120 W. 57th St., New York City.

10 years' experiments are now available. On a tract of good ground sown continuously for 10 years to wheat, the average yield per acre for the first five years was 20.2 bushels, and for the next five 16.92 bushels. Where corn was grown continuously on one plot, the average yield was 16 bushels, while on an adjoining plot where corn was planted but once in five years in a system of rotation, the average yield of the latter for the two years it was under corn was 48.2 bushels per acre.

Evidence such as this should not be ignored, especially by the engineer who would aspire to control the properties which he has created. It is not enough that he should construct new lines of communication whereby virgin soil can be rendered productive, but he must furnish the incentive to would-be settlers to maintain and improve the productive capacity of the soil rather than allow it to become exhausted by improper cultivation.

This is a simple commerical proposition. If the products of the soil are allowed to decline steadily, the freight handled over tributary lines of communication will as certainly follow suit, and inducements to capital, for further extensions, will prove more and more difficult to obtain.

ENGINEERING IDEALS.

In whatever branch of the profession in which we may be engaged, whether we call ourselves Civil, Mechanical, Mining, Electrical, Military, Naval, or even Agricultural Engineers, the only safe guide is a strict adherence to nature's law of least resistance. From the beginning of time, every particle of matter has followed the exact resultant of contending forces, without deviating a hair's breadth from a course which has permitted it to attain a position of equilibrium with the least expenditure of energy, resulting in the most expressive, and therefore impressive, effects.

Whether it be in the growth of a tree, the flow of a river, or the slow but certain modifications of mountain forms, the operation of this law of nature has resulted in the combination of the beautiful with that which is good and true. If, therefore, the engineer would attain to the highest excellence in his profession, he must so utilize the sources of power in nature as to effect the greatest good at the least cost.

He must combine strength and durability with attractive outline and artistic excellence. It is not sufficient that a bridge, for example, shall be strong enough to carry its load. Any engineer who is familiar with the laws of statics can calculate the strains, and proportion the material for a given diagram of a bridge in which the number of panels and relation of height to span is taken arbitrarily. The structure so proportioned will be as strong as may be desired for the purpose, but if the diagram so chosen does not present a pleasing appearance, it will be found that more material has been expended than would have been the case if a more artistic arrangement had been adopted. Again, if in cases where the number of piers is not restricted, the proper relation of cost of superstructure to cost of substructure has not been observed, the total cost of completed structure will be in excess of scientific requirements.

It is true that what is called art has not been considered a fixed science, which is equivalent to saying that the rules which govern artistic construction are not capable of mathematical demonstration. Nevertheless, I believe it will be found to be the fact that the structure which has been designed upon the most scientifically accurate proportions, that is to say, which accomplishes the object for which it was intended in accordance with nature's great law, will present the most pleasing outline, and that eventually the conception of the engineer and the architect will merge into that of the true artist and engineer, of whom the immortal Michael Angelo was the great prototype.

ANNUAL CONVENTION OF THE MASTER CAR BUILDERS' ASSOCIATION.

The annual convention of the Master Car Builders' Association was held last week, for the fifth consecutive time, at Atlantic City, N. J. The delightfully cool and clear weather justified the time and place of meeting and brought to the occasion a pleasure which added much to the more serious work under consideration.

Since the last convention a period of business depression has covered the country, in which the railways and their supplying business houses have suffered at least as much as other industries, but this condition has not affected in any way the attendance on the convention or the size of the exhibition of appliances which is always one of the most valuable parts of these annual railway meetings. In fact, both the attendance and the exhibition were much larger than last year.

PRESIDENT'S ADDRESS.

The first meeting of this, the 42d annual convention, was called to order the morning of June 17, by the President, Mr. George N. Dow (General Mechanical Inspector, Lake Shore & Michigan Southern Ry.). In his annual address Mr. Dow outlined the policy of the association, saying that its two great objects were, first, to secure uniformity of car construction, and second, to secure the most economical results in the interchange of traffic between the railways of the country. In the pursuit of these policies the association had been remarkably successful, for not only have the railways come to recognize the M. C. B. Standards as rulings on disputed points, but in many cases these standards have become the law of the land. Consequently it is necessary for the members to exercise especial care in the deliberations in order truly to represent in the finished proceedings the best in design and practice.

Among the new measures recommended by the president for future action was a revision of the constitution permitting more intimate relations between the various railway associations, particularly the American Railway Association, a reduction of the list of papers at each meeting so as to permit a wider discussion in the time allotted, the adoption of a standard M. C. B. coupler, a more complete study of the steel car problem and the adoption of a standard box car section.

ADDRESS OF MR. E. A. MOSELY.—In accordance with the practice for some years past, Mr. E. A. Mosely, Secretary of the Interstate Commerce Commission, was present at the convention and delivered an address largely upon the relations of the Commission to that part of railway activities represented by the car-builders. He first called attention to the action of the U. S. Supreme Court in declaring unconstitutional, by a bare majority, the employers' liability law of 1907, which law Mr. Mosely had predicted, in his 1907 address, would be approved by that court. However, immediately after the decision, a law was passed by Congress embodying a still more drastic employers' liability provision. It is hoped that the new law will avoid the pronounced unconstitutionality of the old one by confining its operation to the field of commerce subject to federal regulation. Mr. Mosely said:

> The present law provides that if any employee of a carrier by railroad shall become injured while engaged in interstate commerce, because of a violation by the carrier of any statute enacted for the safety of employees, the fact that the injured employee may have been guilty of contributory negligence shall not relieve the carrier from liability; nor does the injured employee assume the risk occasioned by the carrier's violation of such a law. Neither may carriers subject to the statute exempt themselves from the liabilities created by the law by means of any contract or rule. The law therefore greatly increases the financial responsibility of interstate carriers to their employees, and makes it necessary for them to exercise the greatest care in the employment of men, as well as to keep all equipment in proper repair.

Further citations of recent decisions were noted to show the clear intention of the law to require railways to keep their equipment within the safe limits prescribed by rulings of the Commission. In all, prosecutions involving 2,260 violations of the safety appliance laws have been filed. Of this number 1,041 cases have been disposed of by trial, confession of judgment and compromise, and penalties have been collected to the amount of $80,200. Fewer cases have been dismissed by the government, and in 1,207 cases trial is pending. In but 10 cases have decisions unfavorable to the government been rendered, and in these cases the appeals have not in all instances been decided upon.

Throughout, Mr. Mosely tried to impress upon his hearers the vital necessity of safety on the American railway and the important part the master car-builder plays in preserving that safety.

ROUTINE BUSINESS.—In the business meeting it was shown that the association was financially flourishing, and that the membership in all grades was on the increase, now being a total of 726 members. A pleasant incident of this business meeting was the introducing by Dean W. F. M. Goss (University of Illinois) of his successor as dean of the Schools of Engineering of Purdue University, Prof. Charles H. Benjamin. Prof. Benjamin will now have charge of the M. C. B. laboratories at Purdue.

COMMITTEE REPORTS.

A large part of the work of the association is done during the year by certain standing committees whose decisions are approved first by the convention assembled and later by letter ballot to the respective members. These committees have charge of the standards of the association, so that their importance is very marked, but their annual decisions are largely matters of specific detail corrections and amendments, which in themselves have little interest to any but the car-builders themselves, to guide them in their construction and in their rules of interchange. These reports include those of the committees on "Supervision of Standards and Recommended Practice," on "Rules of Interchange," and on "Arbitration." They were all accepted with minor changes and referred to letter ballot. The other committee reports follow; unless otherwise stated, they were accepted and referred to letter ballot.

TRIPLE VALVE TESTS.—In accordance with instructions of last year's convention this committee have had built at Purdue University a new 100-car, 10-in. brake cylinder testing rack. It is expected that this will be in working order in a short time, so that at next year's convention the committee can make a satisfactory report on the performance of triple-valves.

BRAKE-SHOE TESTS.—Dean Goss, chairman of this committee, reported that during the past year five shoes were submitted and tested for frictional qualities under the specifications of the association. As a result of these tests the committee concluded that

> The shoes tested present great variation in the wearing qualities, the ratio between the poorest and the best shoe being as great as 1 to 4.
>
> The relative resistance to wear exhibited by different shoes is somewhat affected by the severity of the application. Of a series of shoes, the one which suffers least from wear at light pressures may not be the one which suffers least under a heavy pressure. Variations of this sort are, however, of small value, and if standards of performance are not too minutely defined, they may be neglected.
>
> Within limits employed by the Committee, whatever may be the pressure, the results clearly distinguish between the slow wearing and the rapid wearing shoe.
>
> All shoes tested wear more rapidly on a steel-tired wheel than on a cast-iron wheel. In general terms it may be said that for the absorption of a given amount of work, the wear upon steel-tired wheels is twice as rapid as upon cast-iron wheels.
>
> The results attest the value of the insert shoe. The work of this year was chiefly confined to shoes of this type because the solid shoes had been worn out by the tests to which the series had previously been subjected.
>
> It is noteworthy that the four shoes showing least wear, on both steel and cast-iron wheels, are all insert shoes, and that all practically meet the Association's specifications as to frictional qualities.

M. C. B. COUPLERS.—In addition to the regular tests carried out annually on couplers by this committee, the work of the past year included several circular letters, sent out to the various railways, inquiring into the causes for coupler failures, into the operation in service of the standard M. C. B. coupler and the use and desirability of the friction draft gear. As a result of these investigations the committee decided that the present standard specification was not sufficiently strict, because a very much larger percentage of failures of accepted couplers occurred than rejections of new couplers for violations of the specifications. They therefore made several recommended changes in the design, tending to make a more rigid specification. In this connection it was suggested by a member that a chemical composition should be specified and, although it was the opinion of the majority of the members that both a chemical and physical specification was requiring too much of the manufacturers, it was resolved that the committee investigate for the coming year the desirability of prescribing the chemical composition of the coupler metal.

Mr. K. H. Sanderson (Virginian Ry.) requested that provision be made in the future for tests on friction draft gears, concerning which there seems to be little present experimental knowledge.

but no action was taken on the request. In connection with some tests he had made he stated that in his opinion the almost obsolete dead block would come back into use again. He based this opinion on the diagram he had derived from his tests in which the oak block curve of deformation under load and impact was practically the same as that for the friction draft gear. It was pointed out, however, by another member that the oak could not be expected to retain its elasticity and would have to be frequently replaced.

REVISION OF RULES FOR LOADING LONG MATERIALS.—This standing committee made some slight alterations and additions to the rules and included in their report several valuable drawings showing methods of loading deep plate girders, heavy block stone, barrels, tires, wheels, railway ties and sewer pipe.

CAST IRON WHEELS.—In the consideration of this report the question of chemical composition again came up. Mr. J. E. Muhlfeld (B. & O. R. R.) who, throughout the convention, was a constant advocate of definite chemical specification, said that the investigations of his road showed that a large proportion of the failed cast iron wheels had an excess of sulphur content. In recognition of this claim and also on account of a dispute on the rejection-testing gage for wheel flanges, the report of the committee was rejected and referred back for future consideration.

SIDE BEARINGS AND CENTER PLATES FOR FREIGHT AND PASSENGER CARS.—Pursuant to the evident wish of last year's convention, the committee brought in several recommendations regarding standards in side bearings and center plates. These recommendations include the use of cast steel center-plates for large cars and malleable iron or cast steel for small cars, and certain prescribed distances between centers of side bearings; but in view of the importance of the subject and the lack of sufficient knowledge the committee thought further investigation necessary. In the discussion there was considerable dispute as to the standard, 60-in., adopted for c. to c. distances of side bearings on four-wheel car trucks and upon the necessary distance between side bearings. In regard to the former, many members thought there was not enough uniformity in present practice to warrant a standard; in regard to the latter it was agreed that although the ideal condition could be that of no pressure or clearance at side bearings, yet practical construction and the results of wear require that some clearance be made. On this account it is desirable that an anti-friction, no clearance side bearing be devised.

The report was referred back to the committee for further consideration.

MINOR COMMITTEES.—Detail changes in design and standards of but routine importance were made by the committees on Pedestals and Journal Boxes for Passenger Cars, and Air-Brake Hose Specifications, and their reports accepted. Similar changes were suggested by the Committee on Box Car Doors and Fixtures, but the report was disapproved and the committee continued. The committees on Lateral Bracing of Steel Freight Cars and Location of Ends of Running Boards reported progress and were continued.

The Committee on Automatic connectors examined all types of such devices procurable from the makers in this country and reported that, of the four types perfected, the one of the putting type with pin and funnel collecting and registering device offered the best possibilities for future investigation and present recommendation. With this opinion the convention disagreed and the committee was continued until next year to make further studies.

The Committee on Tank Cars prescribed certain minor changes in the standards and safety appliances and recommended further investigation into the question of (1) the means of holding the tank to the car without driving down the end sills, and (2) the means of preventing the roll of the cars from causing external pressure.

STANDARD MARKING OF FREIGHT EQUIPMENT CARS.—In accordance with resolutions of the 1907 convention this special committee prepared standards and drawings showing the exact position of all necessary lettering on all sorts of freight equipment cars.

VENTILATING OF COACHES AND SLEEPING CARS.—In an exhaustive report this committee gave an historical account of the ventilating and heating of cars and an extensive description of the various methods now in use on the different roads of the country. The subject was thoroughly discussed in all its phases in a manner altogether too lengthy for an abstract in this report. No specific recommendations were made, the report being rather an outline of the work done and to be done for the benefit of future study.

STANDARDS FOR THE PROTECTION OF TRAINMEN.—The association has long had standards under the above title, but the various annual changes have been so fragmentary and with so little care as to how they affected other portions of the requirements that it was decided last year entirely to revise the whole set of standards. This has been thoroughly accomplished by the committee and the present standards now agree in themselves and with the rulings of the Interstate Commerce Commission and United States statute.

PROTECTIVE COATINGS FOR STEEL CARS. This committee has under test a series of steel cars painted with various coatings, the durability of which cannot be determined in the short time that has elapsed since their painting. It is however, important to note that five out of the six kinds of coating are finished with some sort of a grease or tallow, fish oil, locomotive cylinder oil, linseed oil and glycerine, commercial tallow and a patented compound known as cleanola. This is a somewhat novel idea and its future will be watched with interest.

STEEL PASSENGER CARS.—By far the most exhaustive report during the convention was that of the Committee on Steel Passenger Cars, of which Mr. Arthur M. Waitt was chairman. The committee presented a report of 30 octavo pages followed by 11 large plates treating the history and description of most of the steel passenger coaches that have been built within the past few years, a total of 15. Together with this description was included statistics of the number and variety of the steel cars now in use and discussions upon the standard sectional area of such cars, upper decks vs. elliptical roofs, best construction of the flooring and the inside finish. Upon these subjects the committee expressed no positive opinions, but merely presented both sides of the argument, from testimony of the various railways and the knowledge of the members of the committee.

TOPICAL DISCUSSIONS.—Owing to the great amount of time consumed in the reading and discussion of the committee reports, much of which time was undoubtedly wasted on account of the introduction of subjects entirely aside from the point in question, the topical discussions were for the most part crowded off the program. It was decided, however, that those that were not delivered should be printed in the proceedings of the association. These included discussions on "Stresses to which car wheels are subjected," to be opened by Mr. George L. Fowler; "Manganese or other special steel coupler knuckles. Does it pay to use them?" to be opened by Mr. S. P. Bush; "The advantages and disadvantages of all steel box cars," to be opened by Mr. W. R. McKeen, Jr.; and "The abolishment of the brake beam safety chain," to be opened by Mr. J. J. Hennessey.

The topical discussion on the "Abuse of the Repair Card" resulted in a resolution that all members send letters to their subordinates emphasizing the necessity of fixing to all foreign cars repaired the required "repair card" stating the place and nature of the repairs. This very necessary practice seems to have fallen somewhat into disuse on many roads, and from such disuse much trouble has been caused in the interchange bookkeeping.

SUBJECTS FOR NEXT YEAR.—Recognizing the fact that in the recent past the prescribed subjects for discussion at the convention have been altogether too long for successful presentation, the Committee on Subjects announced but three topics for next year, exclusive of those held over from this year. These three are: (1) Standard structural shapes for steel freight and passenger cars; (2) Standard tests and specification for car bolsters and definite location of side bearings; (3) To recommend as a standard a universal interchangeable steam hose coupler.

EXHIBITION.

It is becoming a stock phrase that each year the appliance and supply exhibition at these conventions "is larger and better than ever before." However, it is strictly applicable this year. The convention and its exhibit moved from the "Steel Pier," where it has been held heretofore, to the larger "Young's Million Dollar Pier," the most southernly of Atlantic City's six piers, and the space devoted to exhibits, though more compact than before, seemed to be much larger and was certainly arranged more advantageously for both exhibitors and visitors. Here, every year, is surely given the best exposition of the developments in the mechanical side of railway operation, and it is well worth the while of every railway man to pay it a visit.

OFFICERS.

In view of the fact that by next year it is expected that there will be a consolidation of the various railway associations, all under the general supervision of the American Railway Association, the nominating committee thought it best to violate an established precedent in the list of officers for the ensuing year, a precedent which has always promoted the three vice-presidents up through their respective numbers to president. This expected consolidation will require that general superintendents or men higher than the master car builder be hereafter in positions of executive control, so with the exception of the incoming president, promoted from first vice-president, the new officers are not master car builders. The officers for 1908-09 are as follows: President, Mr. R. F. McKenna (D., L. & W. R. R.) 1st Vice-President, Mr. F. H. Clark (C., B. & Q. R. R.); 2d vice-president, Mr. T. H. Curtis (L. & N. R. R.); 3d Vice-President, Mr. Le Grand Parish (L., S. & M. S. R. R.); Secretary, Mr. Joseph Taylor, 390 Old Colony Bldg., Chicago, Ill.

COAL PRODUCTION OF THE UNITED STATES in 1907 is summarized as follows by the United States Geological Survey:

State or Territory.	Quantity (short tons).	Value.
Alabama	14,250,454	$18,405,468
Arkansas	2,670,438	4,473,693
California and Alaska	24,089	91,813
Colorado	10,790,236	15,079,449
Georgia	362,401	499,686
Idaho	*7,588	*31,119
Illinois	51,317,146	54,687,382
Indiana	13,985,713	15,114,300
Iowa	7,574,322	12,258,012
Kansas	7,322,449	11,159,698
Kentucky	10,753,124	11,405,038
Maryland	5,532,928	6,623,697
Michigan	2,035,858	3,660,833
Missouri	3,906,294	6,399,616
Montana	2,016,857	3,907,082
New Mexico	2,628,959	3,832,128
North Dakota	347,760	560,199
Ohio	32,142,419	35,324,746
Oklahoma (Ind. T.)	3,642,658	7,433,914
Oregon	70,981	166,304
Pennsylvania:		
Anthracite	85,604,312	163,584,066
Bituminous	150,321,437	155,837,770
Tennessee	6,810,243	8,490,334
Texas	1,648,069	2,778,811
Utah	1,947,607	2,959,769
Virginia	4,710,895	4,807,533
Washington	3,680,532	7,679,801
West Virginia	48,091,583	47,846,630
Wyoming	6,252,990	9,732,668
Total	480,450,042	$614,831,549

*Includes production of Nebraska and Nevada.

The increase over the production of 1906 was 66,292,000 tons or 16%. The average price of bituminous coal at the mines was $1.14 and of anthracite coal, $2.14.

SURVEYS OF RESERVOIR SITES in the Ohio Valley are to be made under direction of A. H. Horton of the U. S. Geological Survey. Headquarters of the survey have been established at Newport, Ky.

REINFORCED-CONCRETE LOCOMOTIVE-COALING STATION ON THE NORFOLK AND WESTERN RY., AT CONCORD, VA.: A TYPE OF THE MOST RECENT EQUIPMENT.*

Reports on the operation of the new locomotive coal and sand station recently placed in service at Concord, Va., on the Norfolk and Western Ry., show an average time required to coal the large passenger engines, on through service, of only 35 seconds, counting from the instant the train stops until it moves away. With a tender capacity of 10 to 13 tons, the fuel supply is seldom entirely gone after initial coaling, so that it requires only five or eight tons to complete the normal load. Because of this performance it is of interest to show the general arrangement of the plant.†

This station was designed by the Link-Belt Co., whose apparatus is used throughout. The building is entirely of reinforced concrete and provides overhead storage facility for 260 tons of coal and 10 tons of dry sand, ground-floor storage for 100 tons of wet sand, engine and boiler-rooms and a shed over the track hopper. Two views of this structure are shown in Fig. 1 and the general arrangement of equipment is indicated on Fig. 2. This design provides for supplying both coal and sand to engines on three tracks—two main tracks which the station spans and one outside track which also is used for dumping coal into the track hopper and shoveling sand into the wet storage bins.

Each of the three service-tracks is supplied with coal through a coaling chute, the flow being controlled by a gear-operated undercut gate. Sand is delivered through special swivelled, telescopic spouts that can be adjusted to suit the position of the locomotive; one of these spouts serves the two inside tracks and another the outside. All chutes and spouts are counterbalanced and, when not in use, are easily swung up and out of the way automatically.

The track hopper for receiving coal from the cars is 10 ft. wide by 12 ft. long [illegible] is fitted, as shown in Fig. 3, with a patented reciprocating apron which feeds the coal in a steady even supply to an elevator of the gravity-discharge type. This elevator, being called upon to [illegible] hard and continuous service, is of particularly rugged construction; it consists of V-shaped steel buckets 36 ins. long by 22 ins. wide by 10 ins. deep attached every 3 ft. between two strands of steel link chain fitted with 4-in. rollers chamfered to admit of lubrication. It has a vertical travel of 60 ft. from the hopper to the top of the pocket and then a horizontal run of 33 ft. over the bin into which it discharges through two two-way chutes. The horizontal run, shown in Fig. 4, has a speed of 50 ft. per minute and a capacity of 50 tons per hour.

The sand storage bin, sand-dryer, engine and

FIG. 1. TWO VIEWS OF A REINFORCED-CONCRETE LOCOMOTIVE COALING STATION AT CONCORD, VA., ON THE NORFOLK AND WESTERN RY.
Designed by The Link-Belt Co., Philadelphia, Pa.

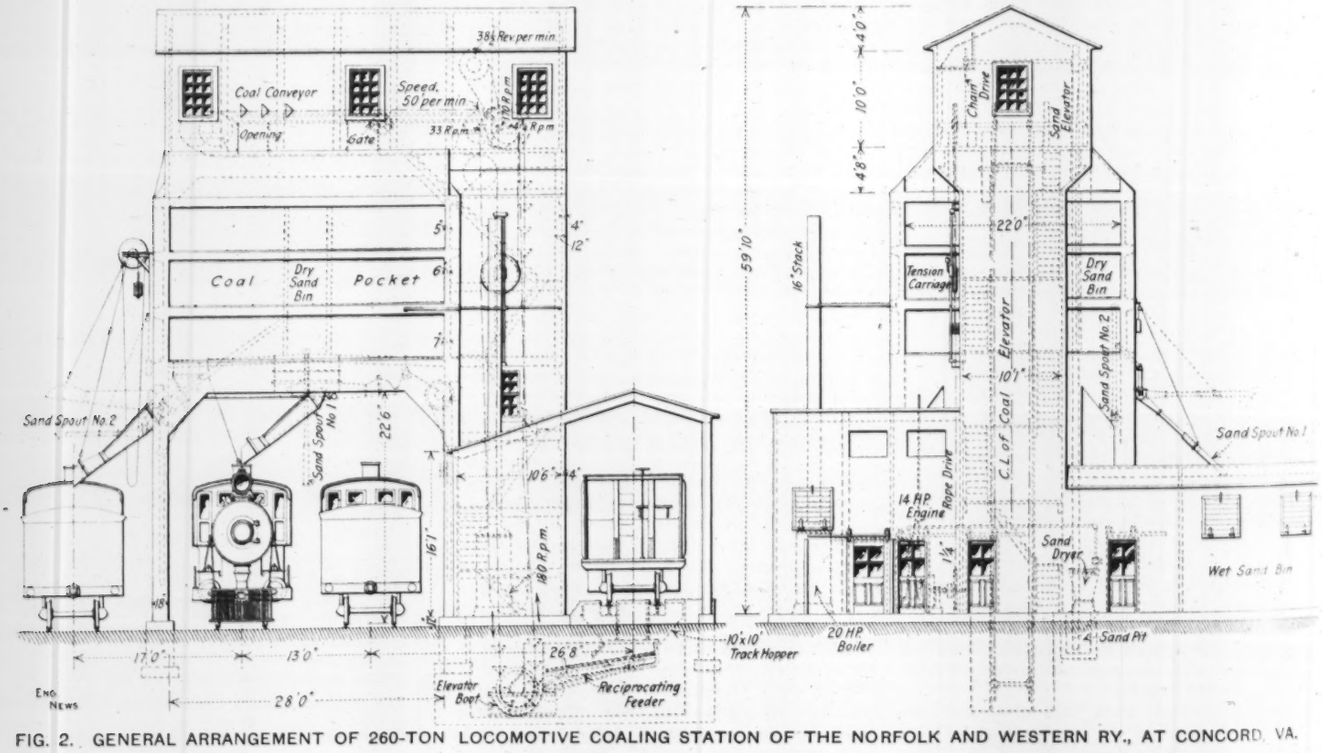


FIG. 2. GENERAL ARRANGEMENT OF 260-TON LOCOMOTIVE COALING STATION OF THE NORFOLK AND WESTERN RY., AT CONCORD, VA.

*From information furnished by the Link-Belt Co., Philadelphia, Pa.

†Several locomotive coal and ash-handling plants were described, with operating costs, by Mr. W. G. Hudson, M. Am. Soc. M. E., in Engineering News, April 16, 1908.

boiler rooms are in the building at the base of the pocket (see Fig 2). Two openings in the upper part of the side wall of the sand bins are fitted with gates hinged at the bottom in such a manner that when let down they rest on the side of the car, forming a bottom that prevents spilling of sand in shoveling. The sand is transferred from wet storage to the dryer as needed and by this is fed to a small belt-bucket elevator shown to left in Fig. 4, which elevates it to

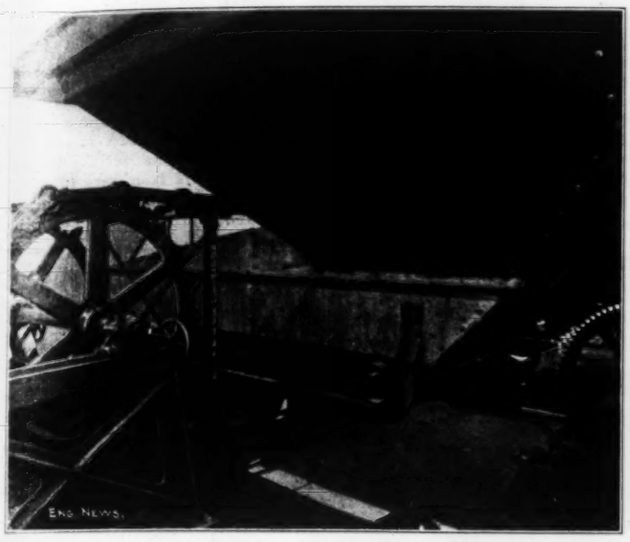


FIG. 3. RECIPROCATING APRON IN HOPPER PIT; LOCOMOTIVE COALING STATION.

the top of the pocket and discharges it at the rate of 10 tons per hour through a spout into the 10-ton dry sand bin.

The power equipment is a 14-HP. vertical steam engine and a 20-HP. vertical boiler. A manila-rope drive (58-ft. centers) is used to transmit power from the engine to the head-shaft of the coal elevator in the lantern of building; a link-belt drive (7-ft. centers) from coal elevator head-shaft operates the sand elevator, as shown in Fig. 4.

COST OF SHALLOW AND DEEP SEWER TRENCHES.

By J. G. PALMER.*

During August, September and October, 1905, a sewer was built, under the writer's supervision, from the new laboratories for the U. S. Department of Agriculture in Washington, D. C., across the Mall to the public sewer at 13th and B Sts., N. W., of which 820 lin. ft. varied between 6 and 13.8 ft. and averaged 8.7 ft. in depth, and 838 lin. ft. varied between 13.8 ft. and 25.3 ft., and averaged 23.5 ft. in depth. These depths are to the bottom of the trench. The cost accounts of the two portions were kept separate, and those that apply to the excavation are given herewith.

The sewer consisted of 1,323 lin. ft. of 18-in., and two branches, aggregating 335 lin. ft., of 12-in. clay pipe, the shallow portion being on the 18-in. sewer, beginning at the outlet, and the deep portion, including 503 lin. ft. of the 18-in. and all of the 12-in. sewer. These measurements include the manholes, which were eight in number. From Sta. 0 + 75 to Sta. 12 + 50 the line was in a park. Here the turf was protected by platforms of 1-in. boards nailed to 2-in. plank laid on the ground. These platforms were continuous, and received all the earth from the trench, being moved in sections as the work progressed.

The trench was 3 ft. wide throughout, this being the width of the widest concrete cradle carrying the pipe, and being required on the smaller sewer by its great depth and the nature of the material. Measuring from the ground surface there was 10 ft. of clay, 10 ft. of fine sand and loam, and the remainder coarse gravel containing many boulders of "one man" size. All excavation was done with picks and shovels, and no water was encountered, the clay in the shallow portion being damp. It is thought that had tiler's spades been used in this portion instead of the picks and shovels the cost would have been reduced.

The trench was braced by screw jacks between 2 × 12-in. plank placed horizontally, and spaced 2 ft. on centers below the clay, the labor cost of bracing being included with that of excavating. The manholes were dug 6 ft. square and 1½ ins. deeper than the trench, the cost being included with that of excavating. The work was well managed, and the labor (negro) was efficient.

FIG. 4. HORIZONTAL RUN OF COAL CONVEYOR AND DRIVE OF SAND ELEVATOR; LOCOMOTIVE COALING PLANT OF THE NORFOLK AND WESTERN RY., CONCORD, VA.

Following is a statement of the cost of excavating and shoring, all days being of eight hours:

Cost of 820 ft. of Trench, Average Depth 8.7 ft. Length Includes 4 Manholes.

General Expenses.*		Cost per lin ft.	
Foreman, 20 days at $5.00	$100.00	$0.122	
Clerk, 20 days at $1.50	30.00	.037	
Watchman, 20 days at $1.50	30.00	.037	
Water boy, 10 days at $1.00	10.00	.012	
Carpenter, 3½ days at $4.00	14.00	.017	
	$184.00		$0.225
Tools $50.00		.061	
3,611 ft. B. M. pine lumber at $18	65.00	.079	
	115.00		.140
	$299.00		$0.365
Excavation and Shoring.			
Laborers, 4¼ days at $2.00	$8.50	$0.010	
Laborers, 262 days at $1.50	393.00	.479	
	$401.50		$0.489

Cost 49 cts. per cu. yd.

Cost of 838 ft. of trench, average depth 23.5 ft. Length includes 4 manholes.

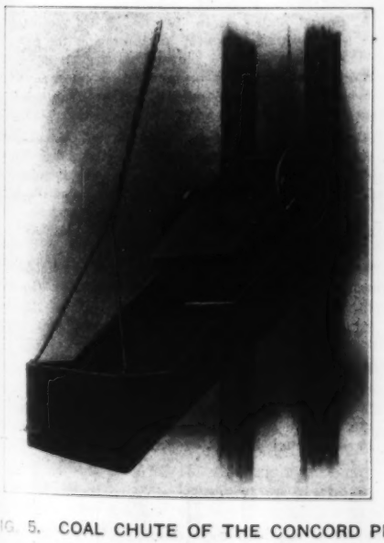
General Expenses*		Cost per lin. ft.	
Foreman, 37 days at $5.00	$185.00	$0.221	
Clerk, 37 days at $1.50	55.50	.066	
Watchman, 37 days at $1.50	55.50	.066	
Water boy 37 days at $1.00	37.00	.044	
	$333.00		$0.397
Tools $50.00		.060	
4,133 ft. B. M. pine lumber at $18.00	74.40	.089	
	124.40		.149
	$457.40		$0.546
Excavating and Shoring.			
Laborers, 993½ days at $1.50	$1,490.25	$1.778	

Cost 66 cts. per cu. yd.

The total cost of this sewer was as follows:

800 ft. of shallow 18-in. sewer	1,972.75	3.772
523 ft. of deep 18-in. sewer	1,972.75	3.775
335 ft. of 12-in. sewer	1,207.64	3.605
8 manholes	340.49	42.56 apiece
	$5,140.32	

*Above pertains to whole cost of completed work.



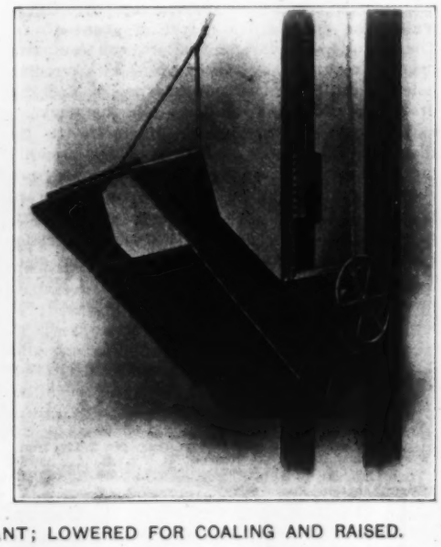


FIG. 5. COAL CHUTE OF THE CONCORD PLANT; LOWERED FOR COALING AND RAISED.

*Inspector, U. S. Department of Agriculture, Washington, D. C.

The whole cost of tools and lumber has been included in the "General Expenses," although there was very little depreciation in their value; but no allowance for the contractors' administrative expenses is included. The contractor was the R. J. Beall Construction Co. of Washington, D. C., and the plans and specifications were prepared by the writer.

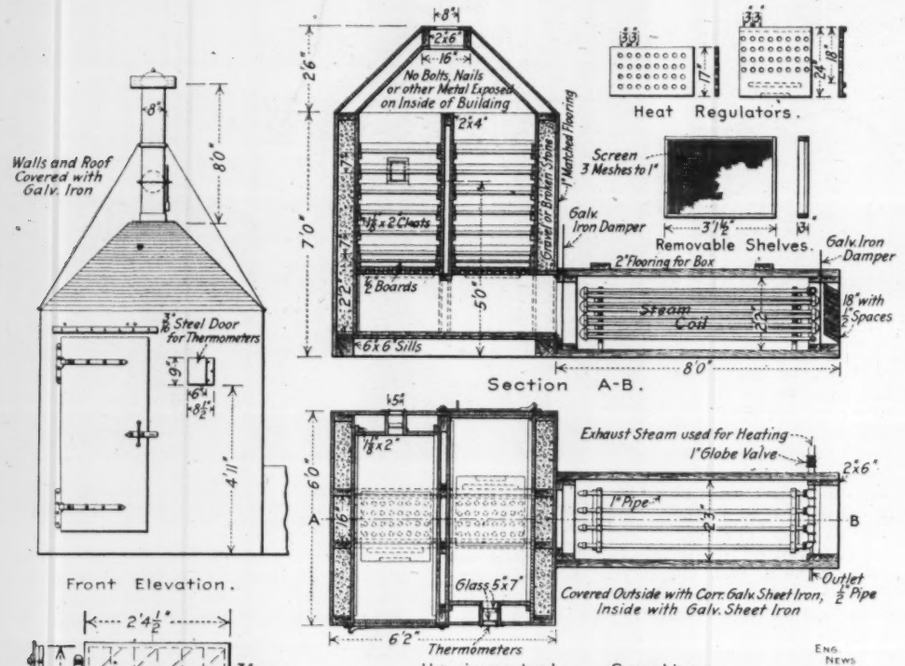
A MAGAZINE AND THAW HOUSE FOR DYNAMITE.

By GEORGE F. SAMUEL.*

The accidents that take place in thawing dynamite are usually due to improper methods used in thawing, rather than to any inherent danger of explosion in the dynamite itself. Where the law places no restrictions on the use of dynamite, it is a common thing for contractors on large jobs (where several hundred pounds of explosives are used daily) to put up a frame building covered with tar paper and having a steam coil in the bottom for thawing the frozen dynamite. A building of this kind is exposed to danger from fire on the outside, an overturning lamp inside, overheating the dynamite from placing the boxes too near the steam pipes, or from sticks of dynamite falling over and coming into actual contact with the steam pipes. When the latter is the case there is the additional danger (with poor quality of dynamite) of the nitroglycerine separating from the dynamite and either falling on the steam pipes or being absorbed by the surrounding material, forming a new explosive.

A recent investigation of the method of thawing dynamite used at a number of quarries and by other large users of dynamite failed to disclose any case where a safe and reliable thaw house was used. The style of thaw house designed by the commissioners appointed to investigate the explosion at the Park Ave. Tunnel in 1902, was described in Engineering News, Dec. 18, 1902. Although designed to avoid the sources of danger mentioned it has never come into general use, as, owing to defective circulation of air, the house was not heated uniformly and consequently failed to thaw the dynamite. For this reason, thaw houses built on this plan have been abandoned when built, and other more or less unsatisfactory methods of thawing used instead.*

The design of thaw house shown in the accompanying cuts was suggested in a discussion of this subject with some of the officials of the Aetna Powder Co., and an experimental thaw house was built and tested at Aetna, Ind. The house is about 5 x 5 ft. inside, and is divided for convenience into two compartments for storing the material to be thawed, and a separate compartment for heating the air. The space to be



A MAGAZINE AND THAW HOUSE FOR DYNAMITE.

used for the dynamite is so arranged as not to allow room for a man to enter, requiring the attendant to remain outside the building while handling the trays, thus avoiding danger of overturning a lamp in the building. The air is heated by passing over the steam coils, and a positive circulation is secured by the stack, which has an effective height of about 15 ft. The quantity of air admitted to each compartment is regulated by the dampers with circular holes in the bottom of the thaw house, and the draft is regulated by the damper in the stack.

The trays containing the dynamite to be thawed are staggered on their supports, presenting a series of baffles; these prevent the air from short circuiting, and force it to come in contact with all the trays. The house is covered with galvanized iron to protect it against creeping fires in grass or underbrush. The 3-16-in. steel plate over the door and the gravel between the walls form protection from bullets. Gravel is preferable to sand for the heat tends to shrink the wood on the inside, giving rise to cracks through which sand escapes.

Thermometers placed inside the house, but so arranged that they can be read from the outside, allow the attendant to keep the temperature under control. A temperature of 80° F. is considered desirable for thawing the dynamite. Good grades of gelatin dynamite may safely be thawed at higher temperatures, but with low grades of dynamite the nitroglycerine is liable to separate if heated much above this temperature. The box containing the steam coils is lined inside and outside with galvanized iron to protect it against fire. Where exhaust steam is used, about 70 sq. ft. of heating surface is required to raise the temperature from zero to 80° F.

The results of tests of a thaw house at Aetna on Jan. 29 and 30, to determine the time required to thaw dynamite frozen at a temperature of — 5° F. are given below. It was intended to use exhaust steam for heating, but this was not available. Live steam was run through a reducing valve and the pressure reduced to 2 lbs., the temperature at this pressure being about the same as that of exhaust steam. The capacity of the thaw house is 540 lbs., and it cost $165.

*Assistant Engineer, Department of Public Works, Chicago.

*A thaw house heated by cans of hot water was illustrated in Engineering News, March 17, 1904; this was for small quantities of explosive.—Ed.

TEST OF THAW HOUSE FOR DYNAMITE.

Time Jan. 29, (7 a. m. to 5 p. m.)....	7	8	9	10	11	12	1	2	3	4	5
Temp. outside, degs. Fahr.....	4	4	2	0	4	6	10	10	10	8	6
Temp. inside, Tray No. 1.....	44	40	40	70	78	80	81	90	94	96	96
Temp. inside, Tray No. 2.....	60	64	64	70	70	70	74	76	76	70	70

Remarks: No. 1 was bottom tray, No 2 top tray. At 10 a. m., top and bottom trays started to thaw; at noon both trays were thawed; at 3 p. m., all powder was thawed.

Time, Jan. 30, (7 a. m to 2 p. m).....	7	8	9	10	11	12	1	2	3	4	5
Temp. outside, degs. Fahr.....	6	0	4	12	16	18	20	23	..	..	..
Temp. in Tray No. 1.....	70	74	80	72	82	82	82	90	..	..	..
Temp. in Tray No. 2.....	40	50	58	68	70	74	74	78	..	..	..

Remarks: 9 a. m., trays Nos. 1 and 2 starting to thaw; 11 a. m., both trays thawed; 2 p. m., all powder thawed and removed.

THE U. S. GEOLOGICAL SURVEY APPROPRIATIONS made in the Sundry Civil Bill enacted by the last Congress reach one and three-fourths million dollars. The appropriations for specific work are as follows:

Geologic surveys	$200,000
Paleontologic researches	10,000
Chemical and physical researches	20,000
Mineral resources report	75,000
Topographic surveys	300,000
Forest-reserve topographic surveys	75,000
Water-resources investigations	100,000
Structural-materials investigations	100,000
Fuel-testing investigations	250,000
Geologic maps, printing and engraving	100,000
Illustrations for reports	18,280
Books for library	2,000
Statutory and temporary salaries	85,240
	$1,335,520

An appropriation of $80,000 for the investigation of Alaskan mineral resources by the Geological Survey was carried in the deficiency bill, passed early in the spring.

An appropriation of $157,350, to be expended under the direction of the Secretary of the Interior, was also made in the Legislative Act for coal-mine inspection in the Territories and for investigating the cause of mining accidents, and the work has been intrusted to the Survey.

A SPECIAL COMMITTEE ON WOOD PRESERVATION has been appointed by the board of directors of the American Railway Engineering and Maintenance-of-Way Association.

A. L. Kuehn, Engineer of track and roadway, Cleveland, Cincinnati, Chicago & St. Louis Railway, is chairman and C. G. Crawford, specialist in wood preservation, United States Forest Service, is its vice-chairman. The first meeting was held in Chicago in the early part of last month for the purpose of organizing and deciding upon a plan of work. The committee was divided into four sub-committees to take up the following lines of work:

Statistics and Economics, O. Chanute, Consulting Engineer, Chicago, Ill., Chairman.

Preservatives and Specifications, H. von Schrenk, Consulting Timber Engineer, St. Louis, Mo., Chairman.

Adaptability of Woods and their Preparation, W. K. Hatt, Civil Engineer, Forest Service, Lafayette, Ind., Chairman.

Treating Processes, C. G. Crawford, Specialist in Wood Preservation, Forest Service, Washington, D. C., Chairman.

A CONCRETE CHURCH WITH ORNAMENTAL CAST CONCRETE DETAILS.

(With inset sheet.)

In East New York, a suburb of Brooklyn, N. Y., there has recently been completed a church, known as "Our Lady of Loretto," which is the most advanced example in the application of concrete to ornate architecture which has come to our notice. Two views, a perspective and a detail of the front, reproduced on an inset sheet in this issue, show better than any description the general effect of the work, but a short account of the construction will be of interest to concrete workers in general.

The church is situated in the midst of one of the crowded and low-class districts that are so common in the outlying parts of Brooklyn, in a parish composed most entirely of Italians, whose love of ostentatious ornament in architecture has led those responsible for the construction of the church beyond the simpler standards usually followed in this country. With the general style and effect of the architecture this article does not deal; that is a matter of taste which we do not propose to discuss. What is novel and worthy of note in the structure is the number of intricate concrete moldings and details, the design and execution of which are far ahead, in quality, of any similar work that has gained publicity.

As the church building proper consists of practically one large room, the problem of constructive details was very simple. In plan it is about 60 x 126 ft., rectangular in shape, with self-supporting walls and exterior pilaster columns supporting the cornices. The one floor, at water-table level, is carried on timber joists by the wall and intermediate columns, and the high roof over the auditorium by a line of columns carrying a series of timber trusses. The whole series of columns and walls rest on slightly spread footings to a solid gravel foundation. The two towers which flank the pediment in front are carried by one interior and three wall columns.

With the exception of one line of short cast-iron intermediate columns, the timber joists and trimmings and some interior plaster decorations, the entire construction is of concrete, slightly reinforced in places against internal stresses, but for the most part either of block or mass work. The walls are of solid concrete block, laid in alternate 4 and 8-in. thicknesses and backed with mass concrete to give the requisite wall thickness, which varies from 30 to 12 ins., according to the load. The pilaster columns are of mass concrete cast upright in place between their various elements, with grooves on the side into which the wall block were fitted as the work progressed. The capitals of the columns, a most intricate Corinthian design, were cast on the ground and set in place on top of the shaft. On top of the capitals, forms were set, with separating partitions for joints at each column, and the lintels, with cornices, cast continuously around the wall. Above the first cornice the walls and columns were carried in the same manner, up to the large pediment which, with its bas-relief 32 ft. long and 10 ft. high, was cast in place in one piece, resting on a solid lintel across the tops of the upper columns. The corner columns of the towers were cast in two pieces on the ground and hoisted into place, but the remainder of the towers was placed in forms. The curved roof arches of these towers are reinforced with rods tied back into the main walls for stability.

As can be noted from the half-tones on the accompanying inset sheet, there are a great number of highly ornate details on the facing of the church. These include the large surmounting bas-relief in the pediment, the column capitals, the two small bas-reliefs over the doorways, the statutes in the niches, the papal keys and crown over the central window and the cornices. In the production of these pieces several methods were employed. In all cases the design was first modeled in clay and from this model a form cast either in plaster or in sculptor's glue. The more refined work was cast in the factory of the constructor at Paterson, N. J., a portion of the remainder on the ground at the site and some, notably the large bas-relief, in place.

The contractor for the work, the firm of Federici Armezzani & Co., of Paterson, N. J., has had long experience in fine concrete casting and the methods used here in the detail work are the result of much study. On account of the varying conditions in the shapes and positions of the pieces, the exact methods employed are not capable of any exact description. The success of the execution depends first, upon the design of the forms, and second, upon the character and placing of the concrete. In the forms the greatest care was taken to make them perfectly solid so that no divergence of line could be noticed after the forms were removed. In the design the returns and projections were so arranged that the concrete could completely fill all voids and the forms be removed without damaging the small details. The mixture was a matter of local determination, affected by the character of the detail and the state of the materials and the weather. In all face work a mixture of cement and fine Franklin sand was used, varying from a 1:1 to a 1:3 mix. The rougher work and the backing was a gravel concrete. Atlas Portland cement was used throughout the work.

A remarkably fine piece of detail work has resulted. Edges and arrises are sharp and accurate and surfaces are smooth and free from holes and cracks, although the work has been exposed to the weather for nearly two years. The one criticism that can be made is that the flat surfaces of the blocks and columns have too much of the smooth, mouse-colored texture that is left on a flushed fine-grained concrete which is not scrubbed, tooled or otherwise treated immediately after the initial set. This surface has somewhat the appearance of a subsequently applied plaster coating, although all pieces were cast intact with no demarcation between backing and surface. Efflorescence also has appeared in many places and the unsightly splotches greatly detract from the generally favorable appearance.

The church building and the adjoining parsonage, which is of similar construction with fewer ornamental details, were designed and built by Federici Armezzani & Co., of Paterson, N. J.

FIG. 1. THE BRICK PIER AND CORNER BAY OF FLOOR SLAB WHICH COLLAPSED.

(Photograph by David B. Edmonston, Washington, D. C.)

AN APARTMENT-HOUSE BUILDING FAILURE, WASHINGTON, D. C.

A building accident on June 9, 1908, in Washington, D. C., in which two men were killed, as briefly reported in our issue of June 18 (p. 678), has aroused rather more than ordinary attention because of President Roosevelt's personal urging that the case be fully prosecuted by the legal authorities of the District of Columbia. The accident is unusual in its technical features moreover. The failure embraced a bay of reinforced-concrete slab floor and a section of brick wall-pier, and no clear evidence has yet appeared which would show whether the pier or the slab was the original seat and cause of the failure.

The photograph, Fig. 1 herewith, shows the damage to the corner pier, and indicates the gap where the corner floor-bay broke out. Details of the construction are given by Fig. 2, drawn after the official plans. The building was originally designed for five stories, and the plans therefor were approved. Later the owner desired to build six stories high, which would have required thicker walls. A permit was finally issued for six stories with the original wall thicknesses, the extra strength required in the rear walls being supplied by columns set inside along the walls. These, however, had not been set, it appears, at the time of the collapse.

The building was to consist of outside brick bearing walls, steel interior columns, steel floor beams connecting the columns, and reinforced concrete slab floors covering in each case the entire bay between columns. The span length of these floors ran up to 15 ft. The slab was to be of 1:2:5 cinder-concrete reinforced with ½-in. twisted "lug"-bars spaced 6 ins. Fig. 2 shows the design arrangement of the rods.

The evidence submitted at the coroner's inquest showed that while workmen were engaged in placing the concrete of the northeast corner bay of the fourth floor, a collapse occurred which involved this bay, the one directly below, the adjacent wall and the corner pilaster. The evidence also showed that the shores under the third floor were removed some days before the accident; the forms for the fourth floor were, of course, supported on the slab of the third floor.

Inspection of the building shows cracks in several other panels, all adjacent to the walls, while the interior slabs, which are supported by steel beams on all four sides, appear to be in good shape. Examination of the floor rods exposed at various points where the concrete has not been completed seems to show that the spacing of the reinforcing rods is irregular and is often, if not generally, much larger than the 6 ins. called for by the plans. The rods, moreover, seem to be some 2 ins. above the bottom of the slab, leaving the effective depth of slab only about 4 ins.

Where the floor slab meets the brick walls, the latter are recessed. The depth of the slot as built, however, is insufficient for proper support, being no more than 1½ ins. in some cases. The weakness at this point was increased, more-

over, by the effects of the difficulty of tamping the concrete solidly into this slot; inspection shows that the concrete was not rammed in at these points sufficiently to give an adequately strong bearing. As the plans show, the shear reinforcement near the ends is limited to an inclined main rod every 12 ins., and the slope of this rod being flat, the resulting shear resistance cannot be large. The duty of transmitting the shear to the end reaction therefore falls largely upon the concrete, so that good quality of the material in and adjacent to the wall recess becomes very important.

The concrete seems to be made of a fairly good quality of mortar and cinders of good quality.

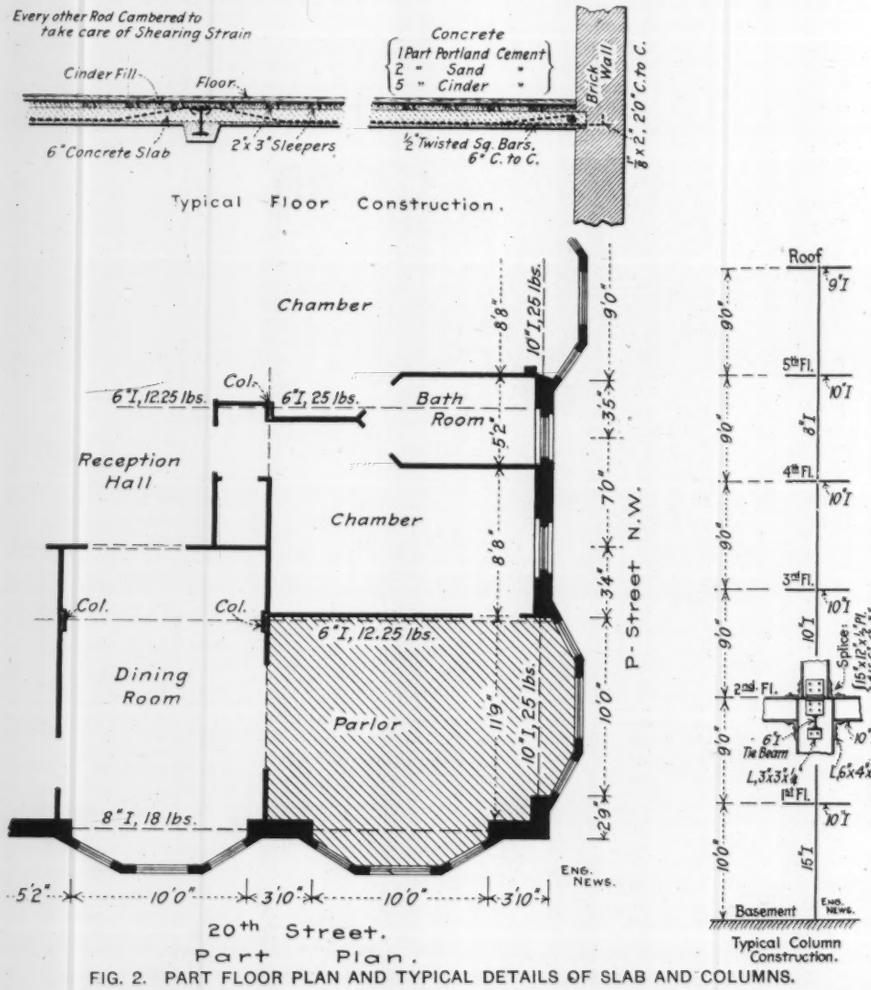


FIG. 2. PART FLOOR PLAN AND TYPICAL DETAILS OF SLAB AND COLUMNS.

Evidence was brought before the coroner, however, to show that the materials were of inferior quality.

The I-beams were connected to the columns (which also consisted of single I-beams) by means of bracket and web-angle fittings of conventional type. At the wall ends, where the beams entered the brick wall, the depth of bearing was not as great as called for in all cases. The testimony also revealed the omission of lug angles on the ends of the beams to bond them to the brick-work, but there is no reason to charge the failure to their omission. Such angles were not called for on the plans, nor were rod anchors shown.

The verdict of the coroner's jury said, in regard to the cause of and responsibility for the accident:

> . . . the cause of the fall . . . we determine to have been the faulty construction of the corner pier, which was not of sufficient strenght, as computed and passed by the building inspector's office.
>
> Therefore we hold the following persons criminally responsible and for the further action of the grand jury:
>
> The District inspector of buildings, Snowden Ashford, for the approval of plans for the said building.
>
> M. J. Blake, the foreman of iron construction, employed by Barber & Ross, for improper construction of the ironwork.
>
> John Frank Bane, the brick contractor, for the hasty construction and use of poor material.
>
> Thomas H. Pickford, for negligence in not having a practical and competent man in charge of the general construction and supervision of the different work of the several contractors.

The list of contractors on the building includes, besides those mentioned in the charge, A. S. Reavis, who was doing the concrete work and the metal lath and plaster fireproofing of the columns. Pickford, the fourth man blamed, is the owner. It appears that he employed the architect only to draw the plans and obtain the building permit, but not to superintend the construction. A. H. Beers, the architect, testified that he had been to the building only three times since it was begun, and that he was not superintendent of construction. The owner, however, appears to have relied on the architect and on the District of Columbia building inspector to see that the work was done properly.

BINDERS FOR COAL BRIQUETS.

The results of investigations on binding materials for coal briquets, made at the fuel testing plant at St. Louis, Mo., are given in a monograph by Mr. James E. Mills and issued by the U. S. Geological Survey as Bulletin No. 343. The fundamental problem is stated to be not the question of how to make the best possible briquet, as the best obtainable binding material may be too expensive in relation to other conditions at any particular locality: the problem is the profitable production of a briquet of satisfactory grade for the use intended. We give the chapter specifying the various kinds of binders, in full:

> Definite answer to the question "What is the best binder to use in making briquets?" depends, as repeatedly emphasized in this paper, on the locality, on the character of the coal, and on the purpose for which the briquets are intended. For purposes of a brief comparison consideration is given to the binders available for a coal which is fairly easy to briquet and which cakes rather readily. A few coals will briquet [illegible] somewhat less and others require greater percent[illegible] of binder, but an endeavor has been made in the [illegible]ving summary to strike a reasonable average.
>
> The experiments herein reported show [illegible] in general, for plants situated where it can be obtai[illegible] the cheapest binder will prove to be the heavy [illegible]ium from petroleum, often known to the trade as [illegible]alt. Four per cent of this binder being sufficient, [illegible] ranges from 45 to 60 cts. per ton of briquets [illegible]ed. This binder is particularly available in Californ[illegible], Texas, and adjacent territory. Second in order of im[illegible]ance comes water-gas tar pitch. Five to six per cent[illegible]ally proving sufficient, the cost of this binder ran[illegible] from 50 to 60 cts. per ton of briquets produced. [illegible] water-gas pitch is also derived from petroleum, it [illegible] be available more particularly in oil-producing r[illegible]s. Third in order of importance is coal-tar pitch. [illegible]g derived from coal, this binder is very widely ava[illegible]le. From 6.5-8% will usually be required, and the cos[illegible]anges from 65 to 90 cts. per ton of briquets produced.
>
> Of local importance, where the price [illegible]mits, are natural asphalts and tars derived from wood distillation. The price of each of these binders varies gr[illegible] with the locality, but there are doubtless places whe[illegible]ey could compete with the binders above mentioned. Wax tailings could be used with an easily caking [illegible]oal. Pitch made from producer-gas tar is not yet on the market, but it will produce excellent briquets, with a lower percentage of binder than other coal-tar pitches. It will doubtless be available in the future. Briquets excellent in all respects except that they are not waterproof can be made by using 1% of starch as a binder, the cost of which is 20 cts. per ton of briquets produced. Extra care is necessary in drying and handling these briquets, and this adds to their cost. The waste sulphite liquor from paper mills also produces excellent briquets except that they are not waterproof. At present it is a troublesome waste product dissolved in much water. Its utilization for this purpose will bear further investigation. Of inorganic binders, magnesia might be utilized, as its probable cost would not exceed 22 to 30 cts. per ton of briquets produced. Other inorganic binders, while available as regards price, would not make first-class briquets.
>
> The briquetting of lignite coal offers a peculiarly difficult problem. If the lignite cakes in the fire, asphaltic residues from petroleum or water-gas tar pitch may be used as binder, larger percentages being required than for ordinary coals. The most promising binders for lignites that do not cake are starch, sulphite liquor, and magnesia. Lignites may be briquetted without binder if they are to be burned on grates specially constructed to overcome the tendency to fall to pieces in the fire.
>
> Attention is called to the suggested method of deciding as to the value of coal-tar pitch for briquetting purposes. The method is likewise applicable to asphalts and petroleum residues generally: (1) The pitch or tar is distilled and all oils coming off below 270° C. are rejected as being of no value; (2) the flowing point of the portion to be used in briquetting is determined (this should generally not be less than 70° C.); (3) pitch is extracted with carbon disulphide. The smaller the amount of residual carbon the more satisfactory is the pitch. The less readily the coal cakes the higher must be the flowing point of the pitch. If a pitch cracker is used, the pitch to work successfully on a hot summer's day must have a flowing point above 120° C. In the winter pitch with a flowing point of 100° C. may be used. All softer pitches and asphalts have to be melted and mixed in liquid form with the coal. A pitch with a very high softening point, above 150° C., should be either thinned or superheated in the mixer. The efficient use of a binder depends very largely on the proper regulation of the conditions in the mixer. The presence of low-volatile compounds in the pitch to be used as a binder increases the smoke in burning; and also increases the tendency of the briquet to soften and crack open in advance of combustion, owing to the volatilization and escape of these compounds.
>
> The main problem in briquetting is to find a suitable binding material at sufficiently low cost. When the difference in price between the slack coal and the first-class lump coal is $1, the cost of briquetting should not exceed this amount. Of this the binder must cost less than 60 cts. per ton, as the cost of manufacture averages about 40 cts. To leave out of consideration the possible advantages in the use of briquetted coal over run-of-mine coal, due to the greater efficiency and smokelessness of briquets, it will probably not be necessary to pay any attention to binding materials costing $1.25 or more per ton of briquets produced.

The behavior of a large number of different coals with various binders was carefully studied in tests determining the percentage of binder required to produce a satisfactory briquet. Their behavior in fire and, when necessary, in water was noted, and conclusions are submitted advising such modifications as are likely to produce most efficient results.

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ADVERTISING

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For nearly a quarter of a century the project has been canvassed to build a railway line to Hudson Bay as the shortest route for exporting to Europe the produce of the Canadian Northwest. Originally the plan was to build a line from Winnipeg to James Bay, and a good deal of energetic promotion work was done on this enterprise in the '80's but without success in securing capital. With the extension of the Canadian railway system in the far north, however, the proposal to reach tidewater on Hudson Bay has again been brought forward. The Canadian Northern Ry. system, built by the energetic Mackenzie & Mann syndicate, now reaches the Saskatchewan River by a branch from Hudson Bay Junction on its main line from Prince Albert to Winnipeg. An extension of some 480 miles would carry this branch to a terminus at Fort Churchill on the western shore of Hudson Bay, located near 59° north latitude. The completion of this line would give a rail haul of 700 to 1,000 miles from the grain raising district of Saskatchewan to tidewater, which is 200 to 300 miles less than the rail haul to shipping points on Lake Superior. Besides the saving in distance, there is a congestion of freight during the crop moving season on the railways which carry the wheat to market from this great wheat belt, and an independent outlet is expected to give relief.

A land grant subsidy to aid the construction of a railway to Hudson Bay has been in force for many years, but has been insufficient to finance the enterprise. It is stated that the Canadian Government will shortly grant a cash subsidy in lieu of the land subsidy and thus ensure the early construction of the road.

A study of the map makes clear that if a Hudson Bay outlet is commercially justifiable at all, it must be made to reach some northern point like Fort Churchill. While a very much shorter line from the new Grand Trunk Pacific Ry. would reach the southern extremity of the bay, freight from the prairies of the Northwest when once hauled that far by rail would continue on its course the short remainder of the distance to Quebec, rather than make the long detour to the north which the Hudson Bay route requires.

It is extremely doubtful whether the Hudson Bay route to Europe can ever be made a commercial success even if a railway is built to the Bay. While the short rail haul and comparatively short ocean voyage is in its favor, the very brief season during which Hudson Strait can be navigated and the dangers from fog and ice to vessels on this far northern route are likely to be a very serious handicap. It will be well-nigh impossible, we judge, to move any considerable part of a season's wheat crop to Europe by this route before the close of navigation. This means that wheat sent by this route will be subject to the extra charge for a year's storage and carrying expenses, besides the heavy insurance due to risks of navigation. Further, the far northern location and the Arctic climate forbids the idea that any considerable population and industry can be developed other than that in connection with the grain movement, and a commerce dependent on a single staple is well-known to be precarious.

While the Hudson Bay project does not hold out great promise, the experiment of testing its possibilities is probably worth making if for no other reason than to satisfy the population of the Northwest which appeals for means to market its crops. There is reason to believe, however, that a better outlet to markets may in time be developed through the growth of mining and other industries in the districts of Alberta, British Columbia and Yukon, and by the completion of the Grand Trunk Pacific Ry. to the terminal on the Pacific coast.

The deplorable lack of any system of training in rescue work at most American mines was again exemplified at Gladstone, Colo., June 7. In the endeavor to save three men who had been caught by foul gas in the Gold King mine, five of the rescuers were themselves overcome and died in the drifts, eight were brought out by following rescue parties in a dangerous condition, and 25 to 30 more were made ill by breathing the poisoned air.

Particulars are lacking as to the causes of the disaster; but it is to be hoped that the fatalities may be taken as a new lesson to teach mine owners and operators the need of better provision for safety in carrying on their business.

The influence of the mining engineers, as a class, we believe, can do much to bring about better conditions. It is true the engineer is an employee of the mine operator, and that the latter is generally concerned more with output and profits than with safety provisions. Nevertheless, a word of warning fitly spoken may very often influence the installation of better ventilating apparatus or a system for rescue work in emergencies.

A correspondent sends us a tabular report of a test on a new "fuel economizer" which appears to be a machine entitled to rank in the same class with power multiplying engines. According to the figures in this table the boilers fitted with this economizer evaporated 18.13 lbs. of water per lb. of coal as an average of five 11-hour tests, which was equivalent to 19.88 lbs. of water evaporated from and at 212° per lb. of combustible. The average for one day's run was 21.57 lbs. of water from and at 212° per lb. of coal. Multiplying 21.57 by 966 (the heat units required to evaporate a pound of water from and at 212°) we find that for every pound of this coal burned 20,836 heat units were utilized in evaporation!

As the very best coals seldom exceed 15,000 heat units in total calorific power, this economizer appears to get more out of the coal than there is in it. No description is given of the economizer other than the statement that it "consists of 12 cast-iron retorts under each boiler placed in rear of the bridge wall," which is about as poor a place to put an economizer as can well be imagined.

An economizer—properly so called—consists simply of additional heating surface placed beyond a boiler to extract heat from the gases which would otherwise pass up the chimney and be lost. The economizer on which this test was made would appear to be a machine for extracting money from uninformed purchasers by pretenses of a performance which it can by no possibility fulfil.

ROCK EXCAVATION BY MECHANICAL POWER INSTEAD OF EXPLOSIVES.

The excavation of rock under water has long been one of the most difficult and expensive tasks of the engineer. Prior to the invention of explosives, rock excavation was not possible at all save by the ancient method of heating the face of the rock by fire and suddenly cooling it or the still more primitive method of forcing off fragments by wedging.

It was centuries after gunpowder was first used in firearms that its application to the industrial work of rock excavation became important; and it was not until the invention of the higher explosives, less susceptible to the action of water than gunpowder, that any important work was done in excavating rock under water by means of explosives.

Many of our readers will recall the public interest excited all over the country in the Centennial year, 1876, when Hallet's Point Reef, at Hell Gate, in the East River, opposite New York City, was blown up by the explosion of 48,000 lbs. of dynamite, placed in galleries which had been excavated in the reef. Almost equal interest was aroused nine years later when Flood Rock, in the same locality, a reef 1,200 ft. long and 600 ft. wide, which had been honeycombed by some four miles of tunnels, was blown up by 280,000 lbs. of high explosive.

Nowadays the removal of submerged rock is an ordinary engineering operation familiar to many contractors for government work; but the cost per cubic yard of rock removal is still many times the cost of rock excavation in the dry.

A score of years or more ago the dredge-building firm of Lobnitz & Co., of Renfrew, Scotland, brought before the engineering world a new method of excavating submerged rock without the use of explosives. It consisted in dropping a mammoth steel chisel on the surface of the rock, and by repeated blows cutting and fracturing it so that it can afterward be removed by dredging. The chisel, with the machinery for hoisting and dropping it, similar to that used for pile driving, is mounted on a scow or barge. The early chisels weighed only four or five tons, but it has been found that chisels of fifteen to twenty tons are much more effective. The chisel point is made of high quality steel, as it has to stand punishment as great as that suffered by an armor piercing projectile. By making the center of the point harder than the outer part the tool is made self-sharpening. In operation the chisel is dropped along a working face, the points of attack being 3 to 4 ft. or more apart.

A great deal has been published concerning the Lobnitz rock breaker in the way of descriptions of the machine and claims for its efficiency; but there is very little authentic data on record as to the actual detailed cost of work done with the machine. In our last issue we published an abstract of a recent paper before the Institution of Civil Engineers in which a detailed report was given of the use of a Lobnitz breaker in the harbor of Blyth, England, and the figures there given are worth careful study.

These figures showed that one of these machines working for 27 weeks broke 24,535 cu. yds. of rock at an average total cost, including interest and depreciation on plant of only 23 cts. per cubic yard. The rock was "a calcareous sandstone in beds alternating with thin layers of shale or coal," and it is stated that portions of it were almost as hard as granite.

We need hardly say to our readers that 23 cts. per cubic yard is a small fraction of the cost of excavating rock under water by any other method known to the engineer. Contract prices for this class of excavation run from $3 per cubic yard upward, and the upper limit, in the case of small amounts of refractory material, in deep water may be as much as thirty or forty dollars, or even more. And the cost of rock excavation under water is mainly the cost of breaking up the ledge. Dredging the broken material is comparatively easy and inexpensive.

If, then, Lobnitz chisels can chop up rock at a cost of only 23 cts. a cubic yard, or even for two or three or four times this cost, the methods involving the use of explosives cannot begin to compete with the Lobnitz system. It might be supposed, therefore, as the Lobnitz breaker was invented over a score of years ago, that it would long before this have displaced all other methods of underwater excavation. The facts are, however, that its use is still quite limited. This is partly due, no doubt, to the conservatism and delay which always attends the introduction of any new invention of revolutionary character; but it is also due probably to limitations of the system. Many of these limitations are pretty clearly indicated by a careful study of the paper in our last issue. The Lobnitz machine is doubtless best adapted to work on a brittle rock lying in horizontal layers and where a considerable area is to be covered by excavation to a moderate depth.

Two chief difficulties with the Lobnitz system are the sticking of the chisel in the hole and the destructive action of the ram against the guides. In tough hardpan or schist the falls of the ram would produce little shattering effect, and the sticking of the ram in the hole would be apt to cause delays. Again, on an uneven surface or in rock with steeply inclined strata the chisel is likely to glance to one side and deliver a good part of the force of its blow against the guides instead of upon the rock.

It may be remembered that the French engineer, Bunau Varilla, was the originator of a plan for deepening a lock level canal at Panama to a sea level by setting a fleet of Lobnitz dredges at work chopping up the material in the bottom of the canal, through the Culebra cut and elsewhere. He urged this plan on the basis of the cost of Lobnitz excavation on the Suez Canal and at other places; but so far as we can see, with the mixture of rock and clay in which most of the digging at Panama is done, the Lobnitz cutters would do very little execution, and would probably become stuck in their holes every few blows.

The Lobnitz cutters have been tried in this country, and one or two are now in use on some New York barge canal contracts held by the Empire Engineering Corporation. No records of their output or the cost of the work done by them have been made public, however, and it is currently reported that many difficulties have been experienced in their operation.

It will be apparent from the description of the Lobnitz system in our last issue that an intelligent and faithful operating crew are first essentials to success. Such men on this side of the water command double or treble the wages paid in England, as recorded in our last issue.*

Besides the contrast in wages, the matter of efficient handling would doubtless be a determining factor in the success of the Lobnitz system. An expert crew would doubtless be essential to good and economical work, and a contractor entrusting the machine to ordinary hands would probably abandon the scheme in disgust.

We cite these as some of the reasons why the Lobnitz system, notwithstanding the fact that it was developed long ago and has achieved some notable records, has only come into very limited use. Yet it appears to be one of the methods of work that should be better known to engineers so that it may be adopted in the localities to which it is particularly adapted.

The idea underlying the Lobnitz system—the breaking up of rock by mechanical energy instead of by explosives—holds more possibilities than engineers are apt to realize. The use of explosives is necessarily costly in comparison with the actual energy developed. A pound of coal contains much more potential energy than a pound of dynamite and costs not a hundredth part as much as the dynamite. Many inventors have wasted time trying to design an engine to be operated by the explosion of gunpowder; but such an engine, if made, would be far too expensive to be a commercial success. Gunpowder owes its energy to the combustion of charcoal and sulphur by combination with the oxygen locked up in saltpeter. All these are expensive chemical elements, costing many times as much as coal, which takes its oxygen from the air, where it costs nothing.

As another practical proof of this statement, compare the cost of pulverizing chunks of rock with dynamite or nitro-glycerine and with a stone crusher. Everyone knows that the mechanically driven crusher is far cheaper.

If then mechanical power can be applied to the work of breaking rock, there is no engineering reason why the work might not be done at a less cost than by explosives.

And in this connection it is well to remember too, that the actual power required to fracture rock is not great as many suppose. A great force must be exerted, but it is force multiplied by distance that tells the energy required, and there is not much stretch to rock. The figures given for the large stone crusher illustrated in our issue of June 4 indicate that a horsepower hour, applied through such a machine, will crush four to ten tons of rock, and most of this power is probably absorbed in the friction of the machine itself. The fact that comparatively little actual mechanical power is required to fracture rock is illustrated by the amount of stone which a good workman can break in a day with a hand hammer. This explains, too, the extensive rupturing of rock which a small amount of high explosive can produce.

Another proposition for the substitution of mechanical power for explosives in excavating rock has recently been exploited in this country in the shape of a tunnel boring machine. A Colorado inventor, a year or two ago, devised a machine consisting of a series of cutters rotated from a central shaft and designed to act against a circular face of rock. A small machine was first built boring a hole three or four feet in diameter, and it was seriously proposed to demonstrate the practicability of the invention by building a machine big enough to bore a full size railway tunnel.

To what extent this invention was pushed in good faith and to what extent it may have been a plan to sell stock to credulous investors, we are uninformed. The original proposal was to use the machine for driving small mine tunnels; but so far as we know it has never reached practical success.

Perhaps it may be wholly impracticable to drive tunnels by any such method; but it must be remembered that the electric transmission of power and other developments in mechanics have brought within the range of practicability a multitude of things which were wholly impossible a few years ago. Modern alloy steels, for instance, give us tools which will stand service that was unthought of a decade ago.

Of course, in breaking rock, the smaller the particles, the more the power required. The boring machine just referred to labored under the disadvantage that the rock in the whole section of the tunnel was reduced to granular form, involving a large expense for power and more wear on tools and machine than would be the case if the output could be of larger size.

Reference may be made here to the fact that this Colorado machine is not wholly without precedent. When the work on the proposed tunnel under the English Channel was started, some 20 years ago, a tunnel boring machine was built which drove a circular section in the soft chalk the full size for the completed tunnel. This machine was reported to be successful; but, of course, the material in which it worked was quite different from the ordinary rock through which tunnels are driven.

It may be pointed out here that if a tunnel boring machine were to be developed and made practicable, it would solve many difficulties that now face the underground worker. Drifts of a true circular section, cut without the use of explosives, would be little likely to cave or require timbering. This latter point is especially important in view of the approaching exhaustion of the forests and consequent scarcity of mine timbers.

To many engineers it may seem quixotic or absurd to think of boring tunnels through solid rock as we bore holes through iron or steel. A little computation, however, shows that while many difficulties of detail might be anticipated, probably would be encountered, there is not anything inherently impossible in the idea. A tunnel 20 ft. in diameter, bored at the rate of 200 ft. per month (about 3 ins. per hour) would mean the breaking up and removal of only 2,330 cubic yds. of rock per month. As we said above, rock fed to a stone crusher can be crushed with an expenditure of power amounting to a horsepower hour for 4 to 10 tons of rock. This is for coarse crushing. For reducing rock to small granules a much larger amount of power would be required, perhaps as much as a horsepower hour per cubic yard. Again, the mechanical action of forcing a chip of rock off the ledge as the tool turns cast-iron in the lathe is doubtless many times as costly in power expended as the crushing of rock in a breaker. Suppose an expenditure of 50 horsepower hours per cubic yard of rock were called for. Even then the power required to drive 200 lin. ft. of 20 ft. tunnel per month would be only:

$$\frac{2{,}300 \text{ (cu. yds.)} \times 50}{720 \text{ (HP. hours in a month)}} = 160 \text{ HP.}$$

With modern appliances for electric power transmission there would be no difficulty in delivering 500 or even 1,000 HP. to a tunnel boring machine. The matter of power requirements, therefore, would seem to present no insurmountable obstacle to the boring of rock tunnels without the use of explosives.

*The captain of the Lobnitz boat working in Blythe harbor is paid $10.70 per week, and the operating engineer $9.70.

LETTERS TO THE EDITOR.

Engineers and the Public.

Sir: Referring to your editorial of April 16, "Concerning Engineers as Members of Commissions" and of June 18, "Concerning American Railway Management": In both of these articles the facts undoubtedly are as related, and very mildly stated too.

The question is, however, whether or no the fact of the individuals mentioned having received an engineering education really has affected their treatment at the hands of the public, or the railway companies.

Science has a profound influence upon character and the study of the laws of nature which are not clearly stated, but which must be discovered first, and then obeyed in the minutest detail under penalty of a failure often involving colossal losses of labor and of life, is apt to make the true engineer hesitating and not self-assertive.

The greatest inventor and engineer of the nineteenth century, whose devices have spread over the civilized world, once said to me, "If people knew how little I know they would not come to me for advice."

Think of a lawyer or doctor or "man of affairs" (whatever that may mean) making such an opening remark to a client with a fat fee! The man was honest in his statement and I kept my money.

That brings up another characteristic of engineers—their honesty due to their technical training, for to succeed in engineering honest plodding toil of the severest kind is necessary and becomes a mental habit.

What sort of chance does this type of manhood have in the bedlam of politics managed by saloonkeepers at the bottom and freebooting lawyers at the surface? Or on our railways, dominated by the buccaneers of finance who are interested only in discovering some new way of "turning the hose in" upon a waterlogged corporation?

Engineers at the outset of their professional careers are taught to work for their money, and being absorbed in the study of the truths of nature are forced to forget the cunning required of "the man of affairs" to possess himself of money and power which he has not earned.

There is another point: a technical education does not train one in worldly wisdom as regards human nature, and therefore the engineer is rarely a successful aspirant for public office—for men become unworthy of study in comparison with science.

True, Washington was a civil engineer, but he was also a soldier, and it was in the latter character that he appealed to his countrymen.

The Pennsylvania Railroad has had a long line of engineers for presidents and for many years it did not list its stock on the New York Exchange.

The pre-eminence of this corporation over all other railway organizations as a legitimate enterprise is undoubtedly due to these facts and to the sense of duty and practical ability of these presidents, who did not and do not adopt the methods of money making used by a Vanderbilt or a Gould.

CHURCH OF OUR LADY OF LORETTO, BROOKLYN, N. Y.

Built of Concrete with Cast-Concrete Ornamentation. Federici Armezzani & Co., Paterson, N. J., Designers and Builders.

As financial or political factors no one of them has been in the public eye in a similar way—they have attended to their business as railroad men.

Whenever our public utilities are properly regulated and operated, then will our engineers be recognized and properly paid as the real producers, and by reflex demand also be placed on public commissions authorized to protect the public.

In an address not long ago I spoke of the engineer's brain as the "dominant force" of our civilization and the press had it the "dormant force" in the paper. Perhaps for the present he was right.

Yours truly, Wm. D. Marks.

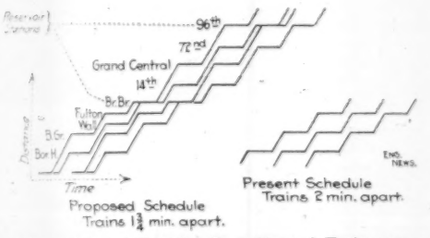
Park Row Building, New York City, June 19, 1908.

The Alternate-Station Plan of Operation Suggested for Rapid-Transit Lines.

Sir: In connection with your editorial remarks on Mr. B. J. Arnold's report on the New York Subway I beg leave to offer the following suggestion, which, I believe, would to some extent relieve the conditions at the 96th St. "throttling point."

Why not let the Bronx Park expresses pass through 96th St. station without stopping? This would relieve some of the pressure for both lines and would be inconvenient for only a small percentage of the passengers. The interchange of passengers would then take place at 72d St., which at present is less crowded than the 96th St. station.

The same principle applied radically to the rapid-transit lines would increase their capacity. It might be used to advantage throughout the present line if the new 96th St. station was built to suit it, and the



"Alternate" and Regular Operation of Trains on a Rapid Transit Line.

Brooklyn Bridge station changed to a "reservoir" station. Trains would then run as indicated on the sketch herewith, every second train stopping at Borough Hall, Wall St., Brooklyn Bridge, 14th St., 72d St. and 96th St., and every alternate one at Bowling Green, Fulton St., Brooklyn Bridge, Grand Central and 96th, with an average of one train every 1¾ mins. on a 1-min. minimum headway, as compared with one train every 2 mins. under the present system with 1-min. headway on the line and ½-min. at stations.

The stops at the "reservoir" stations would, of course, be slightly longer than the present stops, and it would take some time to educate the public to the system, but a few police guards at the "reservoir" stations and a liberal supply of signs on the trains would accomplish a lot in this direction. Yours truly,

J. M. Jorgensen.

620 Lexington Ave., New York City, June 8, 1908.

The Reservoir System for Control of the Ohio River.

Sir: With your kind permission I desire to correct two statements in your editorial of June 11 on the "Reservoir System for Control of the Ohio River," in which my name occurs as apparently endorsing same.

The first is in connection with the acidity of the pools of the Monongahela River during low water periods and likening the river at such times "to a huge reeking cesspool," an expression I never used in regard to the river.

As a matter of fact when the river is approaching a low water stage say with 18 ins. flowing over Dam No. 1 (length 962 ft.), the effect of the spent acids from galvanizing plants, mine waters, etc., is, in conjunction with clay held in suspension, to form a coagulant which rapidly precipitates impurities, staining the river bed and masonry below the water line a bright brick-red color.

As the river continues to decline, it becomes more and more transparent. Until the acid has reached 2 to 4 grains to the gallon it is fine drinking water and is used with impunity by many thousands of people. No pathogenic germs can exist in the water at such times. It should be stated that the percentage of acid at any given spot is subject to great variation, some moving areas being high, while several hundred feet away it may be low. It is safe to say that the river is just the reverse of a cesspool. Curiously enough the human stomach has a far better lining than have steam boilers in its power of resisting attack by mineral acids, for at 2 grains per gallon clean boiler plate will corrode and minute leaks at boiler rivets will begin to enlarge.

The second point to which I desire to take exception is the reference to a remark in my paper on the Monongahela River read recently before the Engineers' Society, W. Pa., relating to the insufficiency of the water supply in occasional years, wherein I had suggested the expediency of constructing several small dams above Lock No. 15 in West Virginia, although I stated that the low water discharge in recent years was greater than was reported many years ago during seasons of drought. Such proposed dams would, however, be very different affairs from the enormous reservoir dams projected for the upper Monongahela as part of a system proposed to control flood heights on the Ohio, furnish water power, and incidentally maintain a navigable depth on that river without the aid of dams with locks.

It is an extremely intricate and difficult problem to combine flood control, water power, and maintenance of a given navigable depth in our western rivers with one set of reservoirs. One would think to restrain floods the reservoirs should be kept empty as much as possible, while for the maintenance of navigation as much as possible of the spare water from the winter and spring storms should be stored. Even with all such spare water over the entire territory above Pittsburg thus stored, the desired depth of 9 ft. for the upper Ohio could not possibly be maintained. Even if that depth could be maintained, as General Mackenzie, Chief of Engineers, U. S. Army, has pointed out, there would be such a strong and constant current that the prospect for a profitable upstream movement of freight in fleets of barges, now entertained by the friends of river improvement, would be poor indeed.

It cannot be too greatly emphasized that unless freight is to be moved in our rivers in the future in great volume at a low rate, they are not worth the cost of improvement, and realizing this fact the cost of transportation is receiving much attention by the U. S. Engineers. There is sufficient experience on the Ohio to demonstrate what is possible for that river when improved by dams with locks for both up and down stream movement of freight in fleets of barges of aggregate capacity of say 5,000 tons up and 12,000 tons down. A persistent depth of 9 ft. or less, in the absence of locks and dams, would be very trying for upward bound fleets, as they would have constantly to breast a powerful current, the depth not being sufficient to develop shore eddies which they would take advantage of, while for the down stream fleets the steamers would be frequently backing, flanking, etc., to avoid running aground. Under such circumstances there would be much lost time, and fuel expense, especially, would be heavy, while for the upward bound steamers they would be able to carry as a rule but little freight on their barges.

River engineers have never, I believe, doubted the possibility of reducing flood heights by means of storage reservoirs. Most of them think, however, the reservoirs should be very numerous, as otherwise the storms may strike regions not under sufficient control, as actually occurred during the March, 1907, flood at Pittsburg. The heavy flood-making rains, which conspired to produce that flood passed through the southern tier of counties of Western Pennsylvania midway between the proposed great reservoirs on the heads of the Monongahela and the Allegheny, so that the reservoirs as projected by Mr. Leighton, in the light of the rainfall records of the United States, West Virginia, Pennsylvania and New York State weather service, would not have been of as much benefit as he believes they would have been. This statement has the support of the actual known discharge over Dam No. 15, below some of the great West Virginia reservoirs, during that flood. Again also in the case of the January, 1907, flood which Mr. Leighton takes to illustrate his theories, he makes the mistake of including the storage effect of the reservoirs above Pittsburg with the reservoirs below that city as tending to reduce the flood height of Jan. 21 at Cincinnati. Cincinnati is 466 miles below Pittsburg, and fully 600 miles or more below some of the largest of the projected reservoirs at the headwaters. It takes usually 4 to 5 days for floods to run from Pittsburg to Cincinnati. The flood at Pittsburg reached its maximum on the 20th, or only one day prior to its maximum height at Cincinnati. Therefore if the whole Ohio River at Pittsburg had been suddenly shut off on the 20th it is difficult to conceive how the elimination of that water could have reduced the flood height at Cincinnati on the 21st. It is plain that the effectiveness of reservoirs for some floods is greatly diminished by distance from the stations sought to be protected.

Among the 30 or more reservoir dams proposed for points above Pittsburg on the Allegheny and Monongahela rivers are several over 200 ft. high, and one of these at the mouth of the Mahoning River, a tributary of the Allegheny, entering 56 miles above Pittsburg, is proposed to be made 251 ft. high. The river valley below this site to Pittsburg, while generally quite narrow, is thickly populated. The proposed reservoir will hold 22 billion cu. ft. of water, or about 40 times as much as the ill-fated Johnstown reservoir held.

It is to be presumed that if the Mahoning reservoir were built, it would be made amply strong with no likelihood of its ever failing. Unfortunately, however, there are some people outside the profession unduly nervous. One of these unfortunates has persisted in asking if I had been to Johnstown and had seen the track of that flood. He also wanted to know what would happen along the Allegheny River if the Mahoning reservoir would burst when there was say, a 30-ft. flood on the Allegheny. Would it fill up its old channel in some places and excavate a new course for itself, etc., etc.?

Here, Mr. Editor, is a poser with all the elements (chiefly unknown factors), for the exercise of the wits of engineers who may desire to investigate problems. The fall of the Allegheny is about 2.2 ft. per mile for many miles above Pittsburg, mean width of stream say 750 ft., bank to bank width 850 ft., hill to hill 1,000 ft. The first wide place is Pittsburg. In a high flood stage the Allegheny in 30 hours passes as much water as the reservoir would hold. The Ohio would carry it off at high flood height in about 14 hours, owing to its greater sectional width. The Johnstown reservoir emptied itself in one hour. The Mahoning might be allowed five hours to do the same, during which time its contents would be spread up and down the Allegheny Valley. Questions as to the depths, slopes and velocities of the river and possible damage this extra water might do at Pittsburg and elsewhere are of interest to nervous inquirers, who will doubtless increase in number and should be answered. It may be mentioned that almost the entire business section of Pittsburg, including the manufacturing and furnace districts, would be submerged by any flood of 10 to 12 ft. greater height than floods of the past.

To conserve floods and develop water-power a suggestion by Mr. J. W. Arras, U. S. Assistant Engineer, Pittsburg District, is worthy of consideration. In brief it is as follows:

1. Numerous small and medium sized reservoirs on the secondary tributaries.
2. With contracted outlets the reservoirs would act as do lakes in lengthening the period of discharge of flood waters.

Unless drawn upon for power the reservoirs would be constantly full.

3. Estimating the dams to range in cost from $5,000 to $100,000, about 2,000 could be built for 100 million dollars.
4. The United States to pay a small bonus for such of the dams which produced no revenue, thus encouraging land owners to construct them for their own benefit and protection.
5. The volume of discharge from water power streams not expected to seriously incommode navigation on the improved Ohio.

Very respectfully,

Thomas P. Roberts.

United States Engineer Office, 411 Federal Building, Pittsburg, Pa., June 16, 1908.

[Referring to the second paragraph of the above letter: We did not credit to Col. Roberts the comparison of the Monongahela pool at Pittsburg to "a huge reeking cesspool," but quoted it by recollection from some published statement which we are now unable to place. Regarding the general subject discussed in the above letter, we may add that Col. Roberts read a paper upon it last year before the Engineers Society of Western Pennsylvania and it was fully and ably discussed by a number of prominent engineers. Readers desiring to study the subject further are referred to the Proceedings of the Engineer's Society of Western Pennsylvania for July and October, 1907.—Ed.]

Notes and Queries.

The Lobnitz rock breaker for submarine rock excavation, described on p. 675 of our issue of June 18 has a cylindrical ram with a point shaped like an armor piercing projectile. In Germany a similar method of rock excavation has been used with square rams terminating in a chisel edge. Work, in deepening the channels of the Danube, the Main and the Rhine has been done on this system, using chisels made by the famous Krupp firm. Messrs. Thos. Prosser & Son, of New York City, American representatives of the Krupp firm, have furnished us the following statement of work done by some of these chisels:

At the Dusseldorf Exposition held in 1902, there was exhibited one of these chisels 31 ft. 2 ins. long, in which had been inserted a tough crucible cutting edge about 10 ft. long. The weight of this chisel was 23,713 lbs. Alongside of this chisel was also exhibited a similar chisel which had been dorn down by use in cutting a field of the hardest slate and grauwacke, which had been removed by 165,600 blows of this chisel. This worn chisel showed that there was no necessity of resharpening its point, this being done by its natural wear.

For deepening the channel of the Main between Gemünden and Kitzingen Fried. Krupp Co. furnished a number of drop chisels to Messrs. Grün & Bilfinger in Mannheim. Each of these chisels sustained over 200,000 blows falling from a height up to 5 meters, the height

of the fall being governed by the thickness of the rock to be removed. These chisels were dropped at the rate of 4 blows a minute. On an average each chisel broke about 4,400 cu. meters (5,755 cu. yds.) of limestone and sandstone, partly in layers and partly compact. The wearing of the drop chisels was up to 1.97 ins. per day working in a sharp grained sandstone such as is used for grindstones.

"HIGH GRADING"; A PICTURE OF GOLDFIELD, NEVADA.*

By T. A. RICKARD, M. Am. Inst. M. E.

Rich ore invites theft. Wherever men find minerals so valuable that a small weight of it represents money, there the temptation to steal is inevitable, the weak guard of conventional morality is broken, and the conscience of the miner is debauched. It does not matter whether it be an old mining community like Bendigo, with its art gallery and botanic gardens, or a younger and richer district, like Kalgoorlie, or an even more recent and more extravagant camp, like Goldfield; in every case the sight of gold, or of the minerals that are known to enclose it, provokes industrial kleptomania.

In Colorado and Nevada they call it "High-grading," that is, the removal of high-grade ore from the possession of the mine-owner to that of the mine-worker. "High-grading" is larceny.

To understand the extraordinary freedom with which rich ore was stolen at Goldfield, it is necessary to appreciate the peculiar labor conditions prevailing in this part of Nevada during the time when the bonanzas in the Mohawk, Red Top, Combination and Florence mines were being exploited. Mining operations were conducted under leasehold; the owners of the mines were, for the most part, without experience of mining, they had no capital, and they did not know where to look for ore; so they granted leases to parties of working miners willing to work, and to adventurous operators willing to furnish the money for exploration. In order to stimulate speculation the lessees organized stock companies, placing the shares on the exchanges of San Francisco, Los Angeles, Salt Lake and Goldfield. Of 100 leasing companies organized in 1906 and 1907, fully 20 struck rich ore and made big profits for a time. Most of them started with just enough money to pay the costs of incorporation and got the capital for their preliminary development by selling shares. As soon as the incorporators had organized they went to the local or State banks and borrowed money on their stock, the bank in its turn endorsing the company as a legitimate mining scheme. The wonderful ore discovered in the Frances Mohawk, Hayes & Monette, Rogers, Little Florence, Red Top, and other leases sustained the whole fabric of fictitious finance until the day of accounting came last October, during the panic. Then the local banks (all save one) shut their doors and the local brokers pulled down their stockboards. The total loss among three banks was fully $1,000,000, while the surviving bank (John S. Cook) had $6,000,000 available. The rate of interest paid by the leasing companies was 1 to 2% per month; the bank officials were interested in the leases and in the stock deals that resulted. The one essential factor missing was uninterrupted prosperity and inexhaustible reserves of rich ore.

The ore was rich indeed. In the Frances Mohawk lease at a depth of 200 ft. there was 8 inches of stuff that assayed $250,000 per ton; it was free gold and calaverite or telluride of gold. The various leases on the Mohawk mine yielded a total of $50,000 per day for 106 consecutive days. One carload shipped to the Selby smelter weighed 47 tons and assayed 000 oz. of gold per ton, so that the shipment was worth $591,637, that is, more than $6 per pound. There were many places in the mines where men knew they were breaking ore worth 10 to 15 dollars per pound. It was easy to steal several pounds of ore. And they did.

It is estimated that last summer over $1,000,000 worth of ore of which no proper account was made went out from the Mohawk and Combination mines, and $500,000 to $750,000 from the Florence. Not less than $1,000 per day of illicit bullion passed through the United States mint at Carson, even after the Goldfield Consolidated mines were closed down, so that most of it must have come from the two Florence leases (the Rogers and the Little Florence). Only $300,000 was recovered last year for the whole camp, despite every effort to find the stolen ore.

It is most difficult to trace the "high-grade," for the thieves crush it at once and so destroy the chance to identify the product from any particular mine. Unless identified positively, the legal evidence is incomplete. The stolen ore is usually taken to a bogus assay office, the proprietor of which pays about 50% of its real worth. The ore is then treated by chlorination; first it is roasted in a muffle and then leached in a barrel with a stirrer. In one case a plant was raided while in operation. The heading assayed 260 oz. gold per ton; the tailing assayed 15 oz. Larceny does not wait on accurate metallurgical method.

*Condensed from "The Mining and Scientific Press" of June 6.

When the owner of this particular establishment was asked what he intended to do with the tailing, he said that this residue would be sold to a man who intended to salt the oxidized ore on a neighboring claim. Even when the circumstantial evidence seems convincing, the local justices are afraid to convict; public opinion regards "high-grading" as rather humorous, the labor unions preach a doctrine by virtue of which a little rich ore is the miner's perquisite,* the rush to become wealthy possesses everyone, and in the excitement the moral law is left high and dry.

It was an orgie of stealing. Regular harnesses were invented for carrying ore under the working-clothes of the miners. They would step from the cage or bucket and stumble heavily laden on their way homeward without being arrested, although the officials knew why they walked so clumsily. One day, for instance, when the men were being hoisted to the surface at the Mohawk shaft, a man came up so loaded with concealed ore that on stepping out of the bucket he fell. The superintendent saw it and called out: "Some one help that son of a gun."

In the Little Florence, there was a hoist underground at the 300-ft. level, and one day the superintendent signalled from a lower level without getting any response, so he climbed up the ladder and found the engineer digging into the bonanza ore in the floor of the level. He was actually getting ready to fire a shot, and had done so previously. In order to escape notice he would time his firing so as to coincide with the blasting in the neighboring stopes, and thus the explosion would pass unheeded.

In another mine, the foreman happened to go into an abandoned cross-cut and found three carloads of the richest ore lying on a platform ready to be sacked and to be removed through a disused shaft at the far end of the cross-cut. The "muckers" or shovelers would handle their shovel so as to leave the heavy fine ore on the bottom of the level and as soon as the men in the stopes shouted "fire," which they would do 10 minutes beforehand, the shovelers would have a chance to collect the rich ore while the shift-bosses and other men were on their way out to the shaft.

At one time it was a rule that men should leave their dinner-buckets at the office. Some of them came on shift with their food in paper bags so as to avoid going to the office. They were warned not to do so. The next day all of them came with paper bags, and the management did not dare to dismiss them. Finally, I may relate the story of the foreman who caught a man loaded with 10 lbs. of "high-grade"; this foreman was notified that there was a watchman paid to do the watching and as he (the foreman) was not a regular watchman he had better attend to his own duties, otherwise the union would have something to say.

And thus we come to the root of it all; the subservience of the lessees to the labor union. Why? Because the ore was rich, and the terms of the leases were short, the lessees could not afford to delay the extraction of ore by having trouble with the men; the men knew it, and so stole as much as they could. Everything was sacrificed to a mad rush to make money, the mines were gutted, honesty was swept aside fiercely, the law was made a dead letter.

The rights of property were not respected because the judges who preside over the local courts owed their position to political election, and this made them subservient to the majority of voters, who happen to be mine-workers. Of the mine-owners and operators many have their homes elsewhere, in California, Utah, Colorado, or New York; they do not vote at Goldfield and they exercise scant political influence. Moreover, a large proportion of the lessees who hired the workers in the mines were ordinary miners and laborers themselves, their good fortune was not conceded as due to any superiority of character or talent, therefore the men who were employed thought it reasonable that they should participate in the luck of those by whom they were employed.

The miners stole rich ore, but so did others who might have been supposed to know better. I know of the president of a mining company (not at Goldfield, but in a neighboring district) who used to visit the mine whose operations he supervised and on the occasion of each visit he filled his dress-suit case or valise with specimen ore. Finally, at the end of the fiscal year he told the manager to debit him with $4,000. The manager told me that he had kept tally on the little shipments that went from the mine in the president's valise, and he estimated the total value of the ore as being at least $22,000.

One of the richest leases at Goldfield was worked by a company organized by a broker; he used to visit the mine in his automobile and take aw... it is estimated that he removed $150,0... he avoided the payment of the 25% r... owners of the mine, not to mention t... to the shareholders in his leasing con...

Every lease had its sequel of litig... differences of opinion as regards the ... law of mine and thine. Thus, the Littl... went 30 ft. over their line and took rich ... not within their lease. In August, 1... pay the Florence-Goldfield Co. not less ... liquidation of a claim for trespass, and ... to make a change in the management ... erations.

To understand the extraordinary con... at Goldfield last year, it is necessary ... insidious effect of having a stock excha... mines and the participation of own... workmen in the wild speculation arisin... lies of wonderfully rich ore. The lead... union were agitators of the worst ty... tance depended upon stirring up strife ... ployers and the employees, their oppo... money hinged largely on the fluctua... caused by labor disturbances and th... them.

During the strike that was ended in A... 1907, the stock market was worked by the labor ... They would call a meeting under pretext ... strike, and the announcement of this fact would lead to the buying of shares by the general public; they would sell short, and then cover their shorts by open purchases made through their wives; this stimulated more buying; then the counting of votes cast at the meeting of the union would be dragged along so as to afford the time necessary to complete the stock transactions. Thus they see-sawed the market five or six times. This broke the brokers, who had been breaking the public.

It was a merciless game of depredation. Never was there a more vivid example of the undermining of character in the presence of wealth; only a few sane men kept their heads in the midst of this scramble for gold, the community as a whole went crazy in the haste to get rich, and threw aside all the scruples of business morality and even the conventions of financial rascality.

Thus at every turn the conclusion is reached that the exploitation of ore of unusual richness is subversive of the integrity alike of the man who digs the ore, the lessee whose property it is, and the lessor to whom the royalty is paid. All of them tried to get more than belonged to them; and when they had finished the scramble for their share, the railroad and the smelter levied a toll that was tantamount to highway robbery. There was not much to choose between them all; it was a case of catch as catch can, with the odds in favor of the one who first placed his hands on the ore—the miner himself.

*It may be mentioned that in olden days on the high seas the captain's graft was formally recognized and termed "primage" because he got it first. Nowadays "primage" is charged in addition to the freight and retained by the ship-owner. The captain does not get it; he no longer participates, he is an employee only. In nearly every industry a similar development can be traced, from open participation to surreptitious graft, and then regulation, which ended all participation in profits.

THE KANSAS CITY TERMINAL PROJECT still remains in the indefinite preliminary stages. Construction work has not been started, nor can it be predicted when it will be started. The company is still negotiating with the city for a franchise ordinance, but the negotiations have been at a standstill since January, owing to the campaign preceding the election of city officials and to the changes in officials following upon the election. It is expected, however, that these negotiations will be resumed shortly. In the meantime, no arrangement of buildings or of the trackage system can be determined. Mr. John V. Hanna, M. Am. Soc. C. E., is Chief Engineer of the Kansas City Terminal Co.

SUGGESTIONS FOR A SNOW FALL METER for use in remote mountain districts where personal observation is impracticable, are desired by the Chief of the U. S. Weather Bureau. Attention is called in the "Reclamation Record" to the following difficulties:

The ordinary straight tube with a receiver is defective because the wind carries the snow past the orifice and thus prevents recording the true amount of fall. All forms of obstructions set up local currents, which also seriously affect the records. When snow is collected and remains for some weeks without measurement, an uncertain amount is lost through evaporation. If sleety snow falls on an open-mouthed receptacle, it is soon clogged and may remain unserviceable for a considerable time.

A TRAVELING BLACKSMITH SHOP which has been experimentally installed by the maintenance-of-way department of the Missouri Pacific Ry. has, according to report in the "Railroad Gazette," proved an efficient and economical innovation. The outfit is composed of two boxcars, one serving as dwelling for the blacksmith and helper, the other as a workshop, fitted with all necessary tools and supplies; the whole is moved from point to point by local freight trains. Frogs, guardrails, switches, track tools, handcars, etc., are repaired where found, saving time and transportation, and inducing repairs to be made which otherwise would be postponed beyond economical limits.

THE WINSTON-SALEM INTERCEPTING SEWER.

By J. N. AMBLER.*

During the season of 1907 a section of the intercepting sewer of Winston, N. C., was rebuilt through the swampy meadows of Salem Creek, south of the city, for a distance of 3,800 ft., and the sewer under, a length of 2,200 ft., was cleaned of its obstructions and put into service.

The circumstances which made this work necessary were the following: The grade of the meadows along Salem Creek, which this sewer traverses for about 6,000 ft., is substantially 1 ft. in 1,000. Since the construction of the original sewer, some seventeen years ago, the population tributary to it has probably doubled. For some years there were added to the domestic sewage a large volume of manufacturing wastes of various kinds, and at one time the waste products of a gas plant, containing much gas tar. Later this was stopped.

The introduction of the meter system on the water-works greatly diminished the relative amount of water diluting the sewage. The meadows lay so little above the level of the creek that an occasional 5-ft. rise of water would hold in check the flow in some 4,000 ft. of sewer. It is thought, also, that the creek rose above the level of some of the manholes near the lower end, washing in sand and mud through the ventilating holes in the covers. Thus a deposit began at the lower end, and, with the very viscid and heavy character of the sewage, aided by the cementing properties of the gas tar, the deposit became so firm that the natural flow on so flat a grade was unable to move it.

These conditions must have been in existence for a number of years, though various more or less successful efforts at cleaning had been made.

One notable effort at cleaning, made by a foreman, consisted in cutting into the sewer at points but a few feet apart, and endeavoring to clean it by scoops. The holes were imperfectly patched, and as the trench lay largely in a flowing blue clay and sand, approaching quicksand, it is thought that the final almost complete obstruction was due to material admitted through these portions of the sewer.

An effort was made to dislodge the obstruction by a powerful jet of water forced into the sewer by a fire engine. This was only partially successful and doubtless injured the sewer otherwise.

Finally, that portion of the sewer from Salem Bridge to Bath Branch, a distance of 3,800 ft., was taken up and laid on the bank until such time as it could be rebuilt. This caused the sewage to be emptied into Bath Branch, whence it flowed into Salem Creek and passed through some 6,000 ft. of the corporate territory before it reached its original outfall below the city.

The condition of these streams and their banks became exceedingly foul, and high water spreading these conditions over the swampy meadows, which were too flat for good drainage, a terrible state of affairs resulted. Complaints from citizens and corporations became insistent, and it was felt that the health of the community was seriously menaced.

In the winter of 1907 the writer was requested to study the conditions, and if possible to prepare plans to relieve them. As the necessary data were almost entirely lacking, a corps was at once placed in the field. A survey was begun at the outfall of the old sewer, and run up the meadows to the temporary outfall into Bath Branch. Three lines of extremely accurate levels were run over the route, and numerous bench-marks established.

REBUILDING A SECTION OF THE SEWER.

The elevation of the surface along the survey was taken, and the tops of existing manholes, as well as the water level and beds of streams at the numerous crossings of drains, spillways, etc. The line was then cross sectioned from the creek on the right, to and beyond the mill race on the left, showing the ground and water levels in sections 200 ft. apart. The character of the ground, with a view to founding, and the character and amount of sewage were also studied, as also the nature and amount of obstructions in the existing portion. The opinion was reached that it would not be wise to build the new portion to as flat a grade as formerly, as conditions (already mentioned) had changed so materially since the old sewer was built that almost any expense would be justified in giving the sewer more fall.

The old location was abandoned, partly because soundings with an iron rod showed that ooze and quicksand existed from 2 to 7 ft. deep beneath the bottom, and partly because it was thought best to put the sewer on higher ground. This relieved the great expense of removing the ooze, building up a new bottom, and a high embankment over the sewer, and also saved the handling of much water. A rate of grade of 2 ft. per 1,000 was determined upon, and so adjusted vertically as to cross the five streams encountered either below or above grade, as no interference with the drainage of the meadows was permitted. Laying the sewer at this higher gradient necessitated building an embankment over it much of the distance.

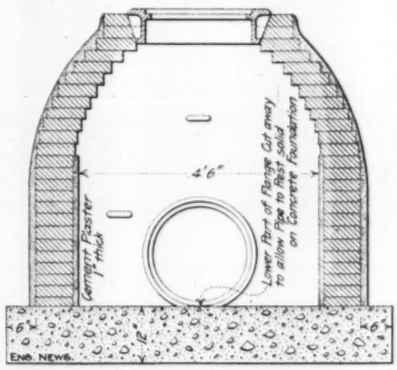


Fig. 1. Section of Manhole on Winston-Salem Intercepting Sewer, Winston, N. C.

It was realized from the first that an artificial foundation would have to be built under the greater portion, if not all, of the work, and that the swampy character of the meadow, with ooze, quicksand, large amounts of surface water, and unknown amounts of sub-surface water to handle, made it impossible to form an estimate of cost that would be worth the making.

As a contractor would figure large profits on a piece of work of this character, and the uncertainties would have to be paid for no matter which way they materialized, being also very difficult to control the work with any prearranged contract, I recommended doing the work with the city's street forces. As none of the foremen, and only one or two of the laborers, had ever worked on a sewer, it was not without misgivings that the work was undertaken, yet these same men, during the five months that the work lasted, gave themselves to it with an interest and devotion to duty that I have never seen surpassed.

The time intervening between the preparation of plans and the arrival of material was spent in draining some of the swamp sections, building a commodious storehouse and shop for cement, tools and supplies, building several bridges, and opening wagon roads.

The work was begun at the manhole where the line crosses Main St., near Salem Bridge. It was impossible to make the connection with the manhole at that time, however, as the 18 or 20 ins. of sewage backed up in the obstructed 24-in. pipe below would have flooded the work ahead for nearly 1,000 ft.

The blind end was covered up, and the work proceeded from this point, laying a 20-in. pipe for 1,813 ft. A manhole (see Fig. 1) was placed every 300 ft., or as near thereto as circumstances permitted. An upturned "T" with a slate cover was placed every 100 ft., and its position noted on the map.

The manholes were provided with a specially-designed cover (Figs. 1 and 2). These covers lock under the top courses of brick so that they cannot be pried up easily. The cover plates are fastened down with set screws to prevent the placing of obstructions in the sewer by malicious persons. In the lateral sewers the covers had been removed and sticks, stones, bricks, old clothing, etc., inserted. The ventilating holes were made very small (¼-in. diameter) so that should an extreme freshet top them, but little harm would be done. As there was nothing to fill these holes up, as on a street, it was felt that they would provide sufficient ventilation and air pressure to regulate the flow. The manholes were built up 3 ft. above the meadow, which seemed to be a little above flood level.

All watercourses were crossed with a sufficient length of lead-calked cast-iron pipe to project well into the banks. Where pipe crossed below the bed of a stream, the stream was dammed and water taken across in a flume. Where pipe crossed above a stream, it was supported on clusters of six 4 × 4-in. piles, 8 ft. long. A small cofferdam was boxed around the heads of the piles and the material excavated well below the bed of stream. The box was then filled with concrete between and above the piles, till it reached the bottom of the cast-iron pipe. Although these foundations were placed in the spillway, where the race is drawn down, and a powerful current results, there has been no sign of settling.

The crossing of the race itself below its bed was effected as follows: It was not permitted to draw off the race, as it supplied feed-water for a large steam plant. The volume of the race was too great to be handled by damming and the use of a flume.

A short diversion channel was cut and the race turned through it. A double cofferdam of sheeting and clay puddle was placed across the race above and below the point of crossing. The interval between these was pumped out, and the sewer laid under the bed to firm ground on the far side, the pile and concrete method being used here also. The race was then turned back, the diversion channel closed and the work proceeded.

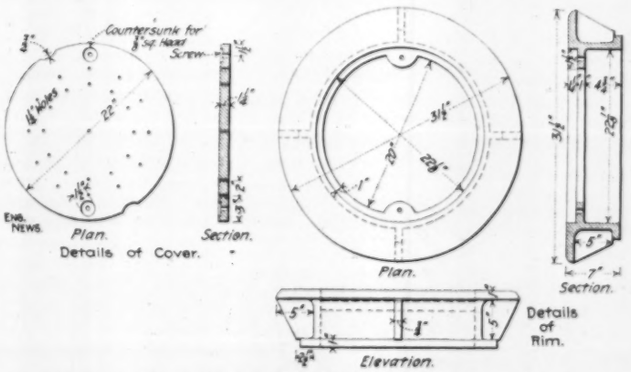


FIG. 2. DETAILS OF MANHOLE COVER, WINSTON, N. C.

The conduit itself was of the best vitrified clay pipe, obtained from the Romona Pipe Works, near Greensboro, N. C. It was laid to line and grade with great precision (see cut of device for lining pipe). The interval between spigot and bell was closed with a ring of tarred hemp, calked back firmly. After this a 1:2 mortar of Portland cement was mixed as stiff as it could be made, and pushed back, partly with a trowel and partly by hand.

So much care was taken with these joints that, on completion of the sewer, only ¼-in. of

*City Engineer, Winston, N. C.

water was found to be flowing in the bottom, although the entire route was through swamp, and crossed under four streams.

The greatest trouble encountered with this work was with the material through which it was constructed. The soil was composed of about 6 ins. of vegetable mold and loam. Under this was a sand bed, with sufficient clay to

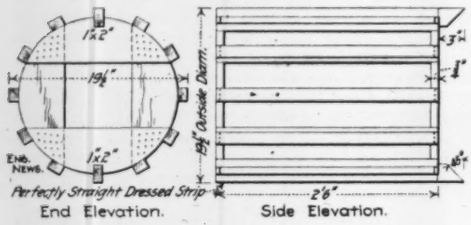


Fig. 3. Device for Alining Sewer Pipe, Winston, N. C.

make it stand up vertical in the trenches for a short time, but not enough to prevent serious sloughing where there was no shoring. As most of the trench was comparatively shallow, only light shoring was required.

Below this sand was a bed of water-bearing sand, which changed imperceptibly into an ooze of blue clay and sand, of such constituency that workmen would always sink in it from 6 to 9 ins., and in some places nearly up to their knees. As it would have been a waste of labor and material to lay the pipe on a bed of this character, some kind of artificial foundation was absolutely necessary. The ordinary plank foundation customarily used in a wet trench was tried and sank out of sight under the workmen, rearing up elsewhere.

It was estimated that a concrete foundation which would be really adequate would cost too much. A pile and platform foundation was therefore adopted.

It was found that 4 × 4-in. scantling could be driven down with reasonable ease by two men with mauls. These piles usually found a firm bearing at 4 to 5 ft. The shortest were 3½ ft., and the longest 6 ft. The scantling was bought in 12-ft. lengths and only small amounts cut at one time, adapting the length to the necessities of the case. Twelve-foot lengths admitted of cutting into several lengths without waste.

The scantlings were driven with their heads at a fixed distance below grade, to allow for the batten, two thicknesses of oak cullings and the grade wedges. (See Fig. 4.) An inch of play was allowed for irregularities in pile driving and in thickness of planks. Ordinarily these matters counterbalanced each other and the platform was found to be within ½-in. of proper elevation. The wedges were tapped in on both sides until the lining device placed in the advance end of the pipe showed that the pipe was at grade. A small batch of concrete was

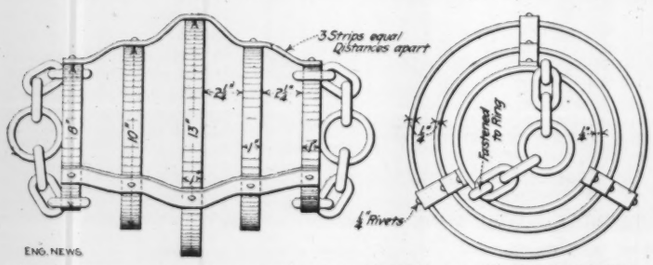


FIG. 5. SEWER CLEANER USED AT WINSTON, N. C.; STEEL BANDS BENT AROUND HOOPS.

placed just behind the wedges of every second pipe, to steady the pipe and prevent rocking.

Grade and line were given by means of grade boards set at a constant height of 7 ft. above grade. At intervals of 25 ft. of the line a 4 × 4-in. scantling was driven on each side of the trench, and far enough away to be safe from ordinary caving. Across this a board was nailed, in a horizontal position, by use of a carpenter's level. These boards were first set to exact elevation by a wye level, but this took so much time that they were afterward set from ½ in. to 1 in. too low, after which a correction nail, which also gave the center line, had its head driven to the correct elevation.

The lining device, and later a modification of it, enabled the placing of the pipe to be done with the precision required by so flat a grade. Usually not more than 300 to 500 ft. were set out at a time, as it was found that some of the boards shrank as much as ½ in.

The manholes in every case needed an artificial foundation, as the underlying material was far too soft and unstable to support the masonry. A ring of 4 × 4-in. piles, usually about 4 ft. long, was driven down, so as to be under the shell of the manhole. The heads were driven down to the same level, so as to project up slightly into the concrete bottom.

In some cases the quicksand seemed to swallow up the concrete, making it necessary to place a considerable quantity of stones of various sizes, upon which to rest the concrete. In one case, where the concrete mixed with the quicksand, the resulting mass was soft and unfit for building brickwork on, but when the top was excavated, was firm enough to hold a new concrete bottom to the manhole.

There was a great deal of water to be contended with at all times, as the bottom of the

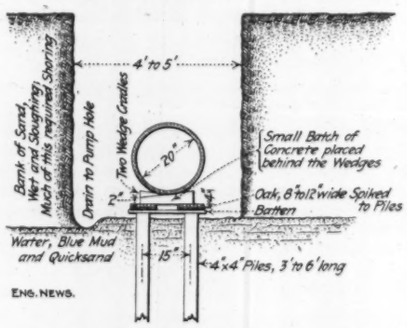

Bank of Sand, Wet and Sloughing, Much of this required Shoring
4' to 5'
Drain to Pump Hole
Two Wedge Cradles
20"
2"
Small Batch of Concrete placed behind the Wedges
Oak, 8"x12" wide Spiked to Piles
Batten
Water, Blue Mud and Quicksand
15"
4"x4" Piles, 3' to 6' long
ENG. NEWS.

Fig. 4 Sewer Pipe Foundation in Soft Ground, Winston, N C.

trench was in the water-bearing strata almost continuously. The trench was widened sufficiently to allow of a small side ditch along one side, collecting the water into a sump, from which it was removed by pumping.

The trench was excavated slightly lower than the platform, to allow of easy building of the woodwork, and to be above any moderate accumulation of water. A diaphragm pump and an old fire engine were in use continually. The latter was, for most purposes, the most economical, in view of the large amounts of water to be handled. It was frequently necessary to pump by this method for two or three hours in the morning before work could be begun. The pump was also run sufficiently long after quitting work to allow the cement laid during the early afternoon to become well set before water rose upon it.

There was no appreciable settlement of the sewer at the time the work was completed, and examination from manhole to manhole since confirms the belief that none has occurred.

The extremely unfavorable conditions under which this work was done, the bad weather and rises of the creek encountered, and the forced nature of the work all conspired to make it expensive. It only remained to use such care and economy of labor and material, day by day, that no unnecessary expense would be incurred.

A large amount of pipe was on hand, so that the sum cost the city at the time of doing the work would not represent the cost of other work of the same class. I have th[illegible] the total cost of pipe into this est[illegible] if all had been purchased for thi[illegible]

It should be remembered that t[illegible] labor, was largely spent in prep[illegible] such as draining swampy areas, b[illegible] bridges, a shop, and refilling the [illegible] large ditch, 2 ft. wide at bott[illegible] slopes of 1:1, and 2 to 4 ft. deep, [illegible] allel to the sewer most of the [illegible] ditches were dug first, their ob[illegible] partially drain the space covered b[illegible] work of the sewer and to furnis[illegible] hand for building an embankm[illegible] sewer, already alluded to as nec[illegible] count of the higher grade of the [illegible] been impossible to separate thes[illegible] the actual cost of constructing th[illegible] and they should not be, as they f[illegible] the total cost of work done under[illegible] tions. The cost figures are as follo[illegible]

20-in. sewer, from Main St. (-- 1 + 13) to [illegible] 17, 1,813 ft. pipe furnished f. o. b. Wi[illegible] at 78¾ cts. per ft.	$1,427.73
18-in. sewer, from Sta. 17 to Sta. 32 [illegible] 1,590 ft. pipe at 59.5 cts. per ft.	946.05
15-in. sewer, from Sta. 32 + 90 to Sta. 36 [illegible] (Bath Branch), 395 ft. at 43¾ cts. per ft.	172.81
13 cast-iron manhole covers at 3¼ cts. per [illegible]	169.00
Total lumber, for all piling, platforms, foun[illegible] dations, wedges, wagon bridges and sho[illegible] Platform made from oak cullings at $1.00 per M. Piles, etc., at $1.50 per M.	568.79
Brick for manholes (brick at $7.50 per M. [illegible] delivered)	108.29
(The total cost of each manhole was about $30[illegible]	
Lead and oakum for cast-iron pipe at stream crossings	36.79
Total labor on sewer and all preparatory works. (One foreman at $75 per mo., one at $55, and one at $50. Day laborers at $1.50 per day).	3,630.26
Cement, for laying sewer and all concrete foundation work. (Old Dominion Portland cement at $2.05 in cloth, laid down).	349.29
Transportation of labor on street car (8 rides for 25 cts.).	67.13
Slate for stopping ends of T's	5.85
Rubber boots	42.25
Nails	20.50
Broken stone for concrete, estimated (quarried and crushed at $1 per cu. yd., hauling $0.75)	150.00
Miscellaneous, including hauling with city's teams	175.98
	$7,931.45

This gives an average cost per foot, of three sizes of sewer, including preparatory works, of $2.08 for the entire distance of 3,798 ft. The preparatory work was begun on March 9, and the sewer completed and thrown into service on Aug. 9, 1907.

As already stated, the work did not cost the above sum when constructed, as about $1,000 worth of material was on hand.

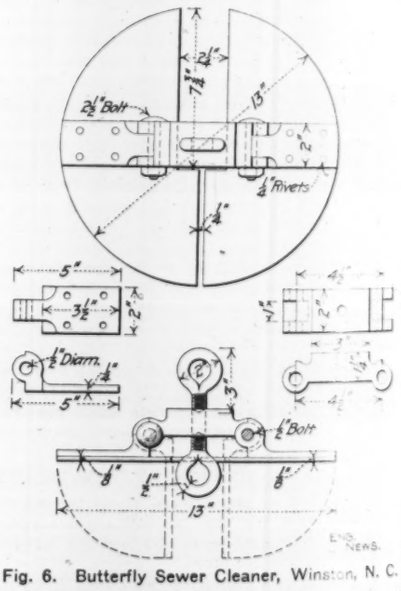


Fig. 6. Butterfly Sewer Cleaner, Winston, N. C.

In Gillette's "Handbook of Cost Data," p. 433, is a table giving the cost of sewers in Newton, Mass., embracing some 60 miles of work, and extending over four years. The cost of 18-in. sewer is given as $1.15 per ft., and of 20-in. as

$1.40 per ft. It is expressly stated that this *is not for work in quicksand.* As the Winston sewer was built for almost its entire distance through quicksand, involving artificial bottom and continuous pumping, stream crossings, draining of swamps, and work to make the place accessible for wagons and workmen, it is not believed that the cost was excessive.

CLEANING A PORTION OF THE INTERCEPTING SEWER.

It now remained to clean that portion of the intercepting sewer, between Main St. and the outfall, a distance of 2,200 ft., of 24-in. pipe, before the new work could be connected with it. It was considered extremely doubtful if this could be accomplished, due to the failure to clean the reaches above. The special devices used are shown by Figs. 5 and 6. This sewer was half full of sand and filth, cemented by gas tar. It was almost entirely obstructed at places by a growth of roots.

A corked bottle was first tied to a string and inserted into the sewer. This, aided by a jet of water thrown into the pipe from an old fire engine, gradually worked its way through to the next manhole. To this string was attached a ¼-in. galvanized steel wire cable. When this was pulled through, the scraping tools were attached.

The tool made of steel bands bent around hoops (Fig. 5) was most effective at first. This loosened up the upper part of the compacted material. The water from the fire engine washed it to the next manhole, where the sewer had been throttled by a board cut to fit, yet which left room at the top for the water to pass over.

By regulating the stream of water, and the agitation produced by the cleaning device, the sand could be made to collect at the bottom of the sewer as fast as it was convenient to remove it with scoops. In this way but little went down the sewer to the reaches below. While this apparatus gave excellent results at the start, in getting the obstructing material loose, it would have been but an extremely slow way to remove the large mass of material found.

The other device, designed by the writer, was called the "butterfly" (Fig. 6). The essential feature was that on being dragged down the sewer the wings opened, taking a considerable amount of matter with it. On being drawn back up the sewer the wings closed, so that it produced but little interference with the matter remaining. The action of this device was also assisted by a stream of water from the engine.

It was found that a better result was obtained after a rigid bar was welded on to the frame of the butterfly on the down-stream side. The steadying effect was very marked. A weight, as a spiral car spring, attached to either device made it work better when the sand was very compact. After the first device had done about all it could do, the butterfly was worked with but one wing attached. It was necessary to have both wings in service to get all the material from the bottom of the sewer. The cable was hauled back and forth by two windlasses, each turned by two men. When the sewer was nearly full, the pulling was very slow and heavy, and at times would have been impossible but for assistance from the fire engine.

A scantling, with a small pulley attached, was inserted into the manholes, which relieved friction of the rope on the brickwork. As this caused a very oblique pull, greatly increasing the labor and expense, work from the manholes was largely discontinued.

A saddle was cut from the sewer with a cold chisel, care being taken not to break the edges of the saddle, or of the remaining part of the pipe. This saddle was usually about 120° of the pipe-ring. Work was carried on from these points to much better advantage. When a section had been cleaned, the saddle was fitted back in place, and from its size and shape, was self-sustaining. A concrete jacket 5 ins. thick was put over it, of sufficient wrap to cover more than 180° of pipe, thus having a strong hold.

A limited use of jointed sewer rods was made, usually in the early work on a section.

In one instance it became necessary for a laborer to crawl several hundred feet into the sewer to release the cleaning device from roots, and to cut the roots away.

The sewer was thoroughly cleaned, all openings covered up and thrown into service in two months.

The cost of foreman was $55 per month, of laborers $1.50 per day of 10 hours. From two to three laborers were employed. The total cost of labor was $144.39, of foreman, $110. The estimated cost of the cleaning devices and supplies was $20. This makes a total cost of $254.39, or about 11.5 cts. per ft.

As this part of the sewer was supposed to be so badly obstructed with compacted material that it would probably have to be taken up and rebuilt, the saving was very great. It is estimated that some 1,500 bushels of material was removed from this 2,200 ft. of sewer.

UTILIZATION OF BLAST-FURNACE SLAG.*

By C. DE SCHWARZ.†

Assuming, upon the basis of recent statistics that the total production of slag for the last year at all blast-furnaces in the world is about 50,000,000 tons, and further that 1 ton of ungranulated blast-furnace slag measures, when broken up, about 20 cu. ft., the blast-furnace slag produced in one year represents a mountain of nearly 1,000,000,000 cu. ft. To dispose of such enormous masses yearly deserves serious consideration, taking into account that the production of pig iron, and with it also that of slag, is steadily increasing, and that the land in the neighborhood of blast-furnaces is, as a rule, of great value.

BLOCKS.—John Payne, an Englishman, was the first who succeeded in utilizing blast-furnace slag for making big solid blocks, up to 3 tons in weight, which were successfully used in building river and canal embankments. According to his method, patented in the year 1728, the liquid slag was first thoroughly worked through with a shovel in order to allow any air or gas bubbles to escape, whilst, at the same time, sand or crushed slag was added. The doughy mass thus received was pressed into cast-iron molds lined with sand. When hard the blocks were withdrawn from the molds and allowed to cool down slowly in a bed of sand mixed with charcoal dust. This method of making blocks could, however, only be used for utilizing blast-furnace slag high in silica and poor in lime, i. e., principally for slag resulting from blast-furnaces worked with charcoal.

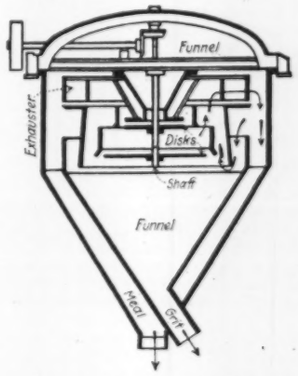


Fig. 1. Mumford & Moodie Air-Separator, Dividing Cement Meal from Unfinished Slag-Grit.

BRICK.—Fritz Lürmann, when at Osnabrück, was the first who recognized and also utilized the hydraulic properties of granulated basic blast-furnace slag for making bricks by mixing granulated blast-furnace slag with lime-cream and pressing this mixture into molds. The lime thus combining with the free silica in the granulated slag served as a cement, and the bricks became hard on free exposure to the atmosphere within from six to eight weeks. The slag bricks produced at the beginning were, however, of inferior quality, and could, on account of their insufficient strength, only be used for masonry of minor importance. It was also found that, during the time of hardening, a good many bricks cracked and fell to pieces.

Considerable improvements were made later on, namely—

a. An automatic feeding apparatus was provided, having for its purpose the maintenance of the proper proportions between the granulated slag and the slaked lime, ascertained by experiment, instead of leaving these proportions to be adjusted as before by the workmen. In general it was found that an addition of 150 lbs. of dry slaked lime to 850 lbs. of granulated slag, containing on an average 20% of water, answered the purpose.

b. Appliances were employed, by means of which an intimate mixture of the slaked lime and the granulated slag was obtained.

c. A press was especially constructed for making the slag bricks. The maximum pressure was raised to about 3,500 lbs. per sq. in., the press being constructed in such a way as to do its work with a gradually increasing pressure, instead of as before, by means of a heavy shock. This had a double advantage: the high pressure was transmitted to the very interior of the brick, which was not the case when the press worked with a shock; and secondly, all superfluous moisture was squeezed out.

d. In order to avoid, as much as possible, any loss from bricks bursting, on account of small particles of unslaked lime being enclosed in the interior of the brick, the slaked lime before use passed through a ball mill where it was reduced to fine powder and intimately mixed. Hereby a complete conversion of any free lime into hydrate of lime was ensured.

One such press with the accessories mentioned, produces about 2,000 slag bricks per hour, the whole requiring about 25 HP. One slag brick of ordinary size, manufactured in the way described, weighs on an average 8 lbs., and has a maximum crushing strength of 1,700 lbs. per sq. in. The working expenses, lime, wages, repairs, and motive power, are stated to be about $2.00 per 1,000 bricks of ordinary size.

Another press for making slag bricks was recently invented by Paul Thomann in Germany. Its peculiarities are an improved mixing apparatus of special construction, for mixing slaked lime and granulated slag, and the method of pressing the bricks. The process is as follows: Slaked lime and granulated slag coming from an automatic feeder are led to the mixing apparatus by means of a band conveyor. The mixing apparatus consists of a small cylindrical sheet-iron vessel containing a mixer with screw-like arms of peculiar shape, in which the materials are, owing to quick rotation, intimately mixed within a short time. The mixture of sand and slaked lime thus produced falls, by means of a hopper, into the brick press which possesses an arrangement by means of which the brick is formed in layers, each layer being hammered down separately, one above the other, until the brick mold is filled up. This arrangement has the advantage of cheap working expenses and small initial outlay. The bricks produced are also comparatively light and have a rough surface, the latter being preferable for masonry.

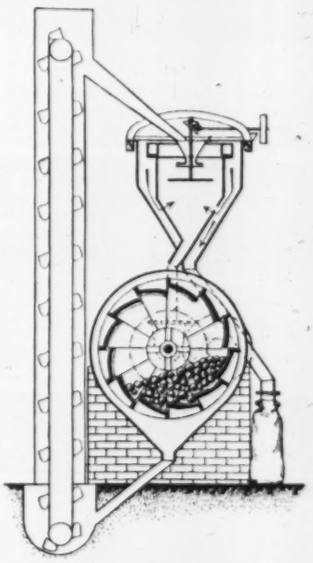


Fig. 2. Complete Ball-Mill, Air-Separator and Elevator Set, for Grinding Blast-Furnace Slag to Cement.

Another method of making slag bricks, still in use, is, mixing one part of Portland cement with from four to five parts of granulated slag and passing this mixture into molds. These bricks must remain in the mold for from twenty-four to thirty hours after being pressed. As they must not be allowed to harden in the open, they remain, after being taken out from the mold, for six to eight weeks in a shed, where they are moistened from time to time. The bricks produced in this way are of very good quality, but their cost of manufacture is high, requiring also a high initial outlay; it can therefore only be recommended for making artificial stones of special size such as staircase steps, slabs, etc.

The best slag bricks, as regards exact shape and dimensions as well as great hardness and resistance to crushing, are manufactured by the English method. According to this process blast-furnace slag can be made into bricks or stones without any addition of cement, slaked lime, or any binding medium. It is based on the fact that insoluble silica is rendered soluble, i. e.,

*Reprint from Iron and Steel Institute Bulletin, May, 1908.

†Liege, Belgium.

ready for combination, if exposed to high steam pressure for a certain length of time. A full description of this method was given in the "Journal of the West of Scotland Iron and Steel Institute" for 1904. These bricks can be transported to their destination and used for masonry as soon as they have left the hardening chamber, described in the above paper. Blast-furnace slag from old slag heaps, even though it has been exposed to free air for several years, can be utilized. The cost of producing 1,000 bricks of ordinary size, according to the English process, is stated to be $3.25.

Slag bricks have the following advantages over the ordinary baked-clay type: They possess considerably higher resistance to crushing; houses of slag brick are never damp, and can be occupied without danger to health as soon as they are built; they are more accurate in shape and dimensions because they are not baked, and therefore do not shrink as clay bricks do. For certain purposes slag bricks, manufactured according to the English process, are, on account of their accurate shape and extreme hardness, preferred even to natural stone; for instance, in Brussels such bricks are used for the facing of walls for houses (Verblendsteine), and paid for at the rate of 60 francs ($12.00) a thousand. For ordinary masonry, slag bricks manufactured by other methods are used, because they are considerably cheaper.

CEMENT.—Of more importance than the manufacture of slag bricks and stones, with reference to the utilization of slag, is the manufacture of cement. This is principally due to the fact that cement, weight for weight, sells at a rate about four times as high as that for brick.

The subject of the utilization of blast-furnace slag for making cement has already been treated in detail in the author's previous papers, read before this Institute in 1900 and 1903, and before the International Congress of Mining and Metallurgy at Liège in 1905, to which he would refer.

Since then the same question has been discussed by several authorities, such as Dr. Passow, Le Chatelier, Wedding, Blount, Thwaite, Day, A. Sheperd, Tantzen, Jesser, Baron Jüptner, Ast, Lünge, Hofer, Struthers, Zulkowsky, and others, who have written about it in different professional papers and pamphlets. The author cannot quite agree in some cases with their statements. For instance, it has been repeatedly asserted that no cement can be made from slag resulting from the manufacture of white pig iron. This is incorrect, as is proved by the fact that Portland cement of good quality can be made from such slag, containing 42% of lime and 4½% of oxide of manganese. This cement did not show the slightest trace of instability of volume even after six years' use; it also stood all the tests required by the standards for Portland cement. The manganese oxide in the cement gave it a brownish color, which however, was not considered a fault by some customers, but on the contrary was preferred to the ordinary tint for making artificial stones.

To a certain extent the presence of metal oxides, such as those of iron and manganese, which, as a rule, are high in slag from white pig iron, gives the cement greater powers of resistance to the influences of sea water. They also reduce the temperature of fritting, necessary for the formation of clinker, effecting a saving in fuel. As the majority of blast-furnace slag produced nowadays results from basic Bessemer iron, it may be considered advisable to draw attention to this fact; hitherto the general belief was that only slag resulting from grey pig can be used for making cement on account of its higher percentage of lime and its small percentage of manganese oxide. It has been proved that a high percentage of lime in Portland cement is not only not necessary, but is even injurious, as, being to a certain extent free, it causes the cement to "blow." Therefore such cement, rich in lime, must be kept for some time in a cement silo before being ready for use, in order to give it time and opportunity to absorb carbonic acid and water from the air for the purpose of converting the free lime it contains into carbonate of lime and into hydrate of lime, respectively. Experience has also shown that cement, rich in lime, cannot be used advantageously for buildings in sea water.

A new process of making cement from blast-furnace slag has been invented by Professor Mathesius at Charlottenburg. This process is based on the principle, already referred to, that insoluble combined silica can be turned into the soluble, combinable state by exposure to high steam pressure. The process is described as follows: The blast-furnace slag is allowed to cool down, when it is put into boilers; here it is exposed to steam pressure until it is reduced to powder. Results of experiments have proved that slag, thus treated, had acquired hydraulic properties, but nothing has been done as yet to use this method commercially.

Of all the processes of making cement from blast-furnace slag invented recently, it appears that only one of them has as yet been accompanied with success, namely, the Colloseus process, called so after the name of the inventor. According to this process, solutions of alkaline salts are injected into the hot liquid slag and thus intimately mixed with the latter, the nature and concentration of the injected solutions depending on the chemical composition of the slag principally on its contents of lime. The quantity of the solution to be injected should be as high as possible; however, the slag thus treated must be perfectly dry after the operation. The salts used are principally alum, sulphate of magnesia, and nitrate of lime, and vary in amount between 2–5% of the solution. They are decomposed by the heat, most of the sulphur escaping as sulphurous acid and sulphuretted hydrogen. The slag is chemically and physically changed, and gets the appearance of a porous clinker easily broken up and reduced to powder. In case slag with a comparatively high percentage of silica and a lower percentage of lime is to be converted into cement, the concentration of the alkaline solution is raised to a maximum of 10% salt to 90% water; a small addition of common cement clinker, rich in lime, has also been found beneficial in such cases.

At the beginning the Colloseus process did not prove successful, principally on account of deficient construction of the granulating apparatus, which did not allow of an intimate mixture between the solutions and the slag. At the same time the selection of the blast-furnace where the first apparatus was put up was not a very fortunate one, as it suffered continually from interruptions; moreover the space available was insufficient. Under these circumstances it was impossible to produce cement of a satisfactory or regular quality. Lately, however, these deficiencies have been overcome by employing improved apparatus.

The working expenses for making cement from blast-furnace slag according to this process are exceedingly low, and the initial outlay for erecting such cement works is moderate, as the drying and grinding of raw materials, as well as brick-making and the burning of clinker, is avoided. As to the quality of this cement, it may be said that, according to information received, it has stood all the tests prescribed for Portland cement by English, French and German authorities. It has been employed for about a year in the erection of viaducts, railway embankments, bridges, houses, etc., showing up to date, not the slightest trace of weakness.

It had several times been pointed out as a drawback to the utilization of blast-furnace slag that it is more difficult to grind than natural raw materials. This reproach is to a certain extent justified, although the difficulty is already largely overcome by granulating the slag, whereby the latter, being cooled down very suddenly, becomes exceedingly brittle.

In addition to this, crushing-mills have been recently invented specially well adapted for grinding slag, and have proved a great success in practice. The ball-mill with air-separator invented by Mumford & Moodie, and made by the Brothers Pfeiffer at Kaiserslautern in Germany, affords an instance of such a mill. The following is a description of this apparatus: Fig. 1 represents a vertical section through the air-separator. An exhauster is fixed, as are two disks on a quickly revolving vertical shaft. The ground material (raw meal or cement) coming from the ball-mill drops into the funnel, and thence to the upper disk from which it is hurled by centrifugal force against the ring. From this it falls to a second disk of greater diameter than the upper one. From this disk again, the material is hurled towards the lower ring. This arrangement has for its prime purpose the distribution of the material as far as possible in the air enclosed by the rings. Through the last ring, which is open below, the air is sucked upward by the exhauster and enters the interior of the two rings as shown by the arrows, taking the fine, finished material along with it, which, after having passed through the exhauster, enters the chamber enclosed by the outer casing, and drops as shown by the arrows, out of the apparatus to be transported to its destination. The air, being sucked up by the exhauster, re-enters the chamber enclosed by the two rings. The unfinished material, or grit, drops from the lower disk into the large funnel and thence into the cushing-mill to be reground. This arrangement has been found very convenient and economical, as all the slag which is ground fine enough is separated and carried away to its destination instead of being unnecessarily ground over again and again, as is done with the so-called tube finishing-mill, causing loss of time and of driving power.

Fig. 2 shows the arrangement of a complete set consisting of a ball-mill, air-separator, and elevator. These sets are manufactured in different sizes for a production of from one to nine tons of finished material per hour, leaving about 12% of residue on a sieve with 30,000 meshes per sq. in.

IRON-ORE CEMENT IN GERMANY

In our issue of Dec. 12, 1907, p. 645, we noted the invention and production in Germany of a so-called ore-cement, in which the usual alumina of Portland cement is replaced by iron-oxide, forming a compound of peculiar advantage in resisting the decomposing effects of sea water. In response to numerous requests for a more complete description of this material, U. S. Consul-General A. W. Thackera, of [illegible]rlin, has made the following report upon th[illegible]oduction and use of this cement in Germany:

While a number of cements are made [illegible] Germany, known as *"Eisencement," "Kraftcement," "Schlackencement,"* etc., which are recom[illegible]ed by the various companies as suitable for hydrau[illegible]rposes, in all probability the "sea-water proof" ce[illegible] or ore-cement (*Erzcement*) mentioned by the i[illegible]y, is that manufactured at Hemmoor, a small villa[illegible] the Oste River about 26 miles from Cuxhaven [illegible] about 50 miles from Hamburg. The product cal[illegible] *Erzcement* "Aegir" is produced under the German pat[illegible]o. 143994, which was taken out in July, 1903, the [illegible]oor company being the licensees. It is claimed t[illegible]e *Erzcement* is a product which can be used [illegible] economy and efficiency for works constructed in [illegible] water, in tunnels, etc., where ordinary Portland cem[illegible]ill deteriorate. The raw materials used in the m[illegible]facture of the product are:

(1) Pure chalk, that is, chalk conta[illegible]96½ to 100% of pure carbonate of lime; (2) roast[illegible]nt stone, very finely ground; and (3) finely ground [illegible]ric oxide.

METHODS OF PRODUCTION—COMPARA[illegible]E TESTS

The ferric oxide is obtained partly from s[illegible]led "bog-iron" ore and other pure iron ores, and [illegible]artly from pure "gravel waste." After the flint ston[illegible]and ferric oxide in the dry state have been ground [illegible]ery finely, all the three materials are worked together [illegible]o a moist paste, which is of so fine a consistency tha[illegible]t it leaves a residue of only 5% maximum on a sieve of 5,000 meshes per sq. cm., or 32,400 meshes per sq. in. After having been dried the paste is burned to a clinker in a rotary kiln and then ground. During the grinding a small portion of raw gypsum is added, the resulting product being the *Erzcement*. The director of the Hemmoor works informs me that in the laboratory extensive experiments have been made with the cement during the past three years. Three different *"Erzcement"* have been tested, of which one was an average sample, composed of cement taken from five batches made at different times, and two were samples, each taken from two large lots. These three *Erzcement* samples were compared with 12 different German Portland cements of the highest reputation, bought in the open market, with slag cement, with a white Portland cement containing a high percentage of chalk and alumina, and with a first-class foreign Portland cement.

All test pieces were tested in fresh water, in ordinary sea water, and in water containing from three to five times more salt than sea water. Furthermore, test pieces were made, containing 2%, 5%, and so on up to 40% of ground, unburned gypsum. While it was known that Portland cements with these high percentages of gypsum would certainly be destroyed, the test pieces were made as stated in order to ascertain whether or not such high contents of gypsum would also act deleteriously on the *Erzcement* test pieces. If the latter remained intact it might be taken for granted that works constructed with the *Erzcement* would resist the action of water containing a great percentage of sulphate.

The three *Erzcements* have stood the test well. The strength of the test pieces made from neat cement and those made from motar, 1 part cement, 3 parts sand, has increased steadily from year to year during the three years the experiments have been carried on, not only in the air, but also in fresh water, in ordinary sea water, and in water containing three and five times more salt than the water from the sea. The test pieces to which were added up to 40% of gypsum, have also remained quite intact up to the present time; they are still of excellent hardness, they sound clear when struck by a hammer, and there is no sign of cracking.

The test pieces made from the various Portland cements have for two years maintained the usual strength which might be expected of a good Portland cement. The test pieces also which were immersed in ordinary sea water have for two years stood well and still show excellent strength, although in each case less than that shown by the test pieces kept in fresh water. Their condition, however, is surpassed by that displayed by the *Erzcement* test pieces. In water, however, containing three times more salt than ordinary sea water, the strength shown by the Portland cement is decreasing heavily, while that of the *Erzcement* is increasing. The difference is still greater in the test pieces immersed in water five times more salt than sea water.

Those cements to which a great percentage of gypsum was added, as far as the Portland cements are concerned, are without exception completely destroyed, while the *Erzcement* pieces are still intact and show great strength 36 months after the immersion in sea water. One of the *Erzcement* pieces with gypsum has now been observed for 42 months and yet does not show any sign of deterioration. The average strength of the Portland cement test pieces without gypsum has during the second year of their immersion in water five times more salt than sea water, decreased 10.8%, whilst the *Erzcement* pieces have increased in strength on an average 4.03%.

From these experiments, which will be continued in the laboratories of the Hemmoor company, the director

states that it might certainly be concluded that works built with *Erzcement* in sea water, as well as in coal mines, [illegible] mines, railroad tunnels, and similar constructions where they are exposed to water containing a great percentage of sulphate, will prove much more durable and more economical than works constructed with the ordinary Portland cement, although the first costs of building would be greater, because the price of *Erzcement* is higher than the best grades of Portland cement.

The price of *Erzcement* manufactured by the Hemmoor company is 7.5 marks ($1.78¾) per barrel of 180 kilos (397 lbs) gross, 170 kilos (375 lbs) net, free alongside ship at Hamburg, net cash. In quantities of 1,000 bbls. the price is 7.25 marks ($1.72¼) per bbl.

I send as an annex to this report copies of a technical treatise on the chemical qualities of various cements, issued by the Hemmoor company, which contains the results of experiments made with various kinds of cements. I also send a copy of the German patent covering the *Erzcement* "Aegir." [These will be loaned to inquirers by the U. S. Bureau of Manufactures.]

From inquiries made of disinterested parties, I learn that the Portland cement produced by the Hemmoor company is one of the best German Portland cements existing, and that the sea water proof cement manufactured by the same company is also a first-class product.

The chief engineer of the vast harbor improvements works which are being carried on at Norden writes me that since 1904 experiments have been made with *Erzcement* which was obtained from the Bürener Portland cement works in Westphalia. The *Erzcement* Beton blocks were compared with those made from Portland cement purchased from the mills at Brackwede and Misburg. In 1905 the Portland cement blocks showed visible cracks, while in 1907 they commenced to decay. The blocks made from *Erzcement*, however, up to the present time have lasted so well that last year it was decided to use *Erzcement* in all repair and new works in the district. Since the commencement of 1907, the *Erzcement* has been obtained from the Hemmoor factory and has given great satisfaction.

An American engineer for the cement industry has translated a pamphlet published by a German cement company covering a series of tests of the resisting and enduring qualities of iron-ore cement and Portland cement, from which the following conclusion was reached by the company:

Through our experiments we arrive at the conclusion that the resistance of the Portland cement which we used for comparative tests depended upon two points, namely, the method of manufacture and the percentage of alumina. Those made under the wet process invariably showed greater constancy of value than those made under the dry process, supposing that the contents of alumina did not vary too much. The amount of alumina, without doubt, is the more decisive factor of the two. All experiments were convincing evidence of the fact that a cement disintegrates the sooner or suffers so much more serious damages within a given time the higher its contents of alumina. Portland cements, being low in alumina, show greater resistance in the presence of gypsum or in sea water than those of a high percentage of alumina, but, in the long run, even the former go to destruction. Iron-ore cement, as previously stated, passed the severest tests without the slightest damage—its contents of alumina never exceeding 1.5%.

All the foregoing statements warrant the declaration that well-burned iron-ore cement is positively superior to Portland cement, if the cement is to be used for marine construction, for sea-water canals, and for all cases in which the concrete comes in contact with sulphuric acid salt solutions. [The translation in full of the experiments by which the foregoing conclusion was reached is on file in the U. S. Bureau of Manufactures.]

THE ROTHERHITHE TUNNEL under the Thames at London was formally opened by the Prince of Wales on June 13. The work was described and illustrated in our issue of Dec. 19, 1907.

THE RAILWAY FROM GUAYAQUIL TO QUITO, whose construction was described in Engineering News Aug. 11, 1904, has been completed. This line crosses the Andes at an elevation of 9,400 ft. The first train will be run on June 25.

A PREMATURE EXPLOSION incurred by the tamping of a charge with an iron rod, by the foreman of a blasting crew, killed him and four of the men, June 19, at the cut-off of the Lackawanna R. R. at Lehigh on the Pocono Mountains.

OVER 5,600 TONS OF DYNAMITE will be required on the Panama canal work in 1909. In addition 2,534 miles of electric fuses, 292 miles of triple tape fuse, over 100 miles of connecting wire and over 600,000 blasting caps are called for. About two-thirds of the dynamite is for use on the Culebra division.

THE NUMBER OF IDLE CARS ON JUNE 10 had dropped to 350,000, a decrease of 31,910 cars from the number reported May 27, two weeks earlier. About 20% of this decrease is accounted for by an increase in the number of cars sent to the shop. The balance appears to reflect genuine improvement in traffic.

THE COST OF BUILDING CONSTRUCTION at Cleveland, Ohio, is claimed to be 28.5% less in 1908 than in 1907, according to figures published by the "American Lumberman" on June 13. While the nominal wage rates are the same, it is possible to obtain a much better class of workers and materials are much lower in price.

A COAL MINE EXPLOSION occurred at shaft No. 1 of the Ellsworth mine at Monongahela City, Pa., June 19. Four men were killed and six seriously injured. The accident was brought about by a miner approaching a pocket of gas with a lighted torch. The damage to the mine is reported to be slight.

A LOCOMOTIVE BOILER EXPLODED on a Grand Trunk freight train running into Imlay City, Mich., June 22, killing the engineer, fatally injured two other trainmen and destroying the engine and three cars. The train was running at about 30 miles an hour at the time; the air brakes set automatically and the train stopped. A similar accident occurred June 23 on the Pennsylvania R. R., near New Brunswick, N. J., when a freight engine boiler blew up, killing the engineer, fireman and flagman. Investigation of this case is expected to show that the boiler-water had been allowed to run too low.

THE GREAT DAM AT AUSTIN, TEX., whose failure some ten years ago attracted the attention of engineers the world over, may be rebuilt. Work is in progress with diamond drills testing the rock underlying the dam site to determine its solidity. After the disastrous experience with the first dam it is deemed wise to make certain of the material on which a new structure will rest.

A SETTLING BASIN at the Chain of Rocks pumping station, St. Louis, was emptied recently by a peculiar accident. In building the settling basin, which was of comparatively recent construction, it was necessary to leave in position beneath it an old drain pipe made of clay sewer pipe. The high water in the race backed up through this drain pipe and broke it and penetrated a bed of quicksand, thus undermining a small section of the reservoir bottom and the water escaped through the channel thus formed.

THE TALLEST CHIMNEY IN THE WORLD is now under construction at the Great Falls, Montana, smelter of the Amalgamated Copper Co. This stack has a foundation 74 ft. in diameter and will rise to a height of 506 ft. with a 54-ft. diam. top. Its location is on a bluff overlooking the Missouri River, and connection with the furnaces will be made by a flue, 20 ft. high, 48 ft. wide and 1,800 ft. long. The tallest chimney hitherto built is that of the Halsbrucker Hutte near Freiberg, Germany, 460 ft. in height.

THE WILLIAM H. BALDWIN PRIZE, offered annually by the National Municipal League, has as its subject for the year 1908-09, "A Study of the Practical Operations of Government in Some Large American City." The competition will be limited to undergraduate students "registered in a regular course in any college or university of the United States offering distinct instruction in municipal government." Any city having a population of not less than 300,000 may be selected as a subject for a competitive essay. Further details may be secured by addressing the National Municipal League, North American Building, Philadelphia, Pa.

THREE TRAIN COLLISIONS with serious consequences occurred on June 19, near Pendleton, Mo., twenty-one persons were injured when a passenger train and a freight met on the Wabash road; both engines, the baggage and mail cars and a number of freight cars being demolished. On the Meadville and Cambridge Springs suburban electric line a passenger car telescoped a freight car on a sharp curve near Bakertown, Pa., twenty passengers being injured, one fatally, the latter being Mr. M. C. Mills, superintendent of the line. At Slawson Junction, near Los Angeles, Cal., two persons were killed in a rear-end collision of two interurban electric cars.

THE HOLLAND-AMERICA LINER "ROTTERDAM" reached the port of New York City, June 22, on her maiden trip. The passage from Rotterdam was made in eight days. The vessel is of 24,170 gross register tons. It was built at Belfast by Harland & Wolff, is 677 ft. over all, has 78 ft. beam and 56 ft. depth of hold. A speed of 18 knots was attained on the trial trip and the same speed was made for several days of the maiden voyage. The twin-screw engines are of 14,000 HP. The principal feature of the ship is the large amount of space placed at the convenience of passengers; the state rooms are more commodious than those of any steamer that has entered New York harbor, and the promenade deck makes a record for size with 12,000 sq. ft. of walking space. The total accommodations provided are for 525 first, 515 second and 2,500 third class passengers.

WELL-AIMED PILE DRIVING is reported from Puget Sound. The following clipping gives details of the feat:

WHALE IMPALED ON PILE DRIVER.

An immense blackfish or finback whale 30 ft. long located itself under a pile driver at a fish trap location near the entrance to Deception Pass a few days ago. The pile was pushed clear through the huge body of the fish and was pounded into the tide lands underneath by the heavy driver hammer. The struggles of the fish shook the pile driver so violently that the loftman fell from the second station of the driver rigging to the deck, and was rescued from drowning only by the prompt action of John Nelson, working on the deck.—Anacortes correspondence Seattle "Post-Intelligencer."

This story of a whale in the New York "Sun" seems a whale of a fish story, but it is so novel that we may let the deception pass.

THE ECONOMIC USE OF COAL ON LOCOMOTIVES.—The general superintendent of motive power of the Pennsylvania Railroad Co. has issued instructions to all enginemen and firemen on the company's lines, for the economical use of coal. The general order is detailed as follows:

1. Enginemen and firemen must work together so as to save coal and reduce smoke.
2. Enginemen and firemen when taking charge of a locomotive must see that the fire, grates and ash pan are in good condition so as to prevent engine failures on the road.
3. Enginemen must include in their reports on M. P. Form 62 all defects causing leaks of steam or water in any part of the locomotive, as the repairs of these defects will avoid loss of coal.
4. The burning of bituminous coal in a locomotive requires air, which must be admitted through the grates and through the fire door.

Smoke means waste of coal and must be avoided.

Large quantities of coal placed in the firebox at one time cool down the fire, cause smoke and waste coal; small quantities at regular intervals will keep the fire bright, prevent smoke and take less coal to keep up steam pressure.

Lumps of coal should be broken in pieces not larger than three inches.

5. A bright and level fire over the whole grate must be carried whenever possible. When a sloping fire is used, no more coal should be banked at the door than is necessary.
6. To prevent smoke and to save coal, the fire door must be placed on or against the latch after firing coal or using the scraper, slash bar or hook, and when on sidings, in yards, at terminals or before starting.
7. Before the throttle is closed, the blower must be used and the door placed on the latch. Firemen must stop firing long enough before steam is shut off to prevent smoke and waste of coal.
8. Dead spots in the fire must be avoided when running with throttle closed, as this frequently causes flues to leak.
9. The grates must be shaken as often as is necessary to clear the fire of ash and clinker in order to admit sufficient air, and in such a manner as to avoid the loss of good fire. Care should be taken to place the grates level after each operation.
10. The waste of steam at safety valves must be avoided. One shovel full of coal is required to make the steam that escapes from a safety valve in one minute.
11. The sprinkling hose attached to the injector must be used frequently to keep down dust on the foot plate and in the cab, and to wet coal in the tender. However, too much water on the coal should be avoided, as to some extent this practice is the cause of flues stopping up.
12. Coal must not be allowed to collect or remain on the foot plate, but should be swept into the coal space of tender, and not out on the tracks.
13. Engines must not be brought into terminals with a dead fire, which will cause flues to leak; nor with too heavy a fire, which will cause waste of coal.
14. When banking or cleaning fires, the blower should be used as lightly as possible. After the fire has been cleaned of ash and clinker, the clean fire must be placed at the front end of the grates and maintained in good condition.
15. When cleaning fires or with a banked fire, excessive use of the injectors must be avoided, as this will result in injury to the flues.
16. The overloading of tenders at coaling stations must be avoided, to prevent the danger and waste from coal falling off.
17. Coal can be saved by the proper use of the injector in pumping locomotive regularly, and by taking advantage of every opportunity to fill boiler when not working locomotive to full capacity; also by using the injector to avoid the safety valves blowing off.
18. Coal will be saved by always working the locomotive (except when starting) with a full throttle when the cut-off is one-quarter of the stroke or greater; but if one-quarter cut-off with full throttle gives more power or speed than is needed, the reverse lever should be left at one-quarter cut-off and the throttle partially closed as needed.

THREE SEVERE FIRES occurred during the last week. In the forests of northern Michigan heavy loss, estimated at $200,000, was sustained in Presque Isle and Cheboygan Counties on June 20, heavy gales fanning the conflagration.—The town of Port Chester, N. Y., was, on June 22, in danger of being wiped out, six near-by towns lending the aid of their fire-fighting service to restrain the flames to one block of the business section; the loss here is placed at $350,000.—A fire which broke out in Three Rivers, Quebec, June 22, consumed the greater part of the lower town, containing the business section. Firemen were brought by special trains from Montreal, Quebec, Sherbrooke and Grand Mere and checked the flames after about three hundred buildings had been destroyed at a loss reported at $1,000,000.

THE COLLISION OF JUNE 5 on the Annapolis, Washington & Baltimore Electric Ry., in which nine people were killed, has been investigated by a coroner's jury, which has set forth the cause as follows:

1. By Motorman Wadsworth and Conductor Bernasco receiving a defaced or scratched order.
2. By the inexperience and ignorance of Operator Schumacher in issuing a defaced and scratched order in direct violation of rule 334, Book of Rules, governing the movement of trains and the duties of employees.
3. That the conductor and motorman of car 21 should have taken precautions to clear train 133 five minutes, according to rule 320.
4. That there was negligence in the movement of the trains on June 5, 1908.

It appeared from the testimony that the order on which the extra car was running was partially scratched out, and the precaution common in steam railway service of issuing duplicate orders to two trains which are to meet at a certain point was not practised at all. The regular train was running between 60 and 70 miles an hour to make up lost time when the collision occurred.

TWO MORE OF THE OLD FRENCH SELF-PROPELling barges are being rebuilt for work at Panama. The "Canal Record" of June 10 says:

Clapet No. 2 was raised in March from the scrap pile at Folks River from which several others have been taken. The frames were in good condition and there was only one streak to renew at the water-line. The stern plates are being renewed, new boiler saddles and engine foundations put in, and water-tight bulkheads between the mud bin and the hull are being constructed. A new boiler has been installed but the engine used by the French will be continued in service. Unlike the other clapets raised, which have two screws, this is a single propeller barge. The capacity is 275 cu. yds. It will be ready for service July 1, when it will be added to the barges that take the spoil from the old French dredges at work in Limon Bay. The repairs will cost $15,000 and the new boiler and new machinery about $5,000.

In a few weeks another of these clapets, No. 1, left by the French in Folks River, will be raised and put in the dry dock for reconstruction. These clapets are built of iron and, although abandoned 20 years ago and lying in salt water ever since, they are in such condition that they well repay the cost of repairing them.

THE COST OF MACADAMIZING ROADS IN New Jersey as shown by the 1907 report of the State Commissioner of Public Roads, is summarized in the table below. The roads in question are those built under the State Aid Law, since 1892. The law provides that the State shall pay one-third the cost of roads improved under certain conditions. The improvement consists in reducing grades, perfecting drainage, and paving with telford, macadam or gravel. The figures given below refer to such improvement alone, and do not include any expenses of original construction or right-of-way, except that occasional small amounts of real estate required for straightening a road are included.

Cost of Road Improvement in New Jersey.

	Miles.	Total contract cost.	Average cost per mile.
Completed in 1907:			
1907 appropriations	52.32	$362,765.64	$6,933
1906 appropriations	31.01	345,774.27	11,150
Begun in 1907	63.09	416,138.45	6,596
Total State-Aid Road Improvement:			
1892-1907 inclusive	1,235.09	$6,849,021.00	$5,544

The high figure of average cost for the second item, road-improvement work completed in 1907 but begun on the 1906 appropriations, is explained by the inclusion of two very costly pieces of work, one of which, 1.46 miles long, cost $80,018.76, while the other, 1.07 miles, cost $33,344.65, the corresponding costs per mile being $54,807 and $31,163. Both these roads involve deep rock cuts to reduce grades over ridges of the Watchung Mountains. Taking out these two road improvements, the item is reduced to an average of $8,162. This figure is still considerably above the other averages of the table, which is explained by the fact that several of the roads covered by it were in marshy ground near the sea-shore, or in rough hill country, and not only was their completion delayed beyond the year in which they were begun, but their cost per mile ran up to something over $10,000.

The public road improvements in New Jersey for 1907 include also about four miles of previously improved road taken over by the counties in addition to some toll-roads bought by counties and included in the total of 52.32 miles. The 1907 work, counting in the mileage for which improvements were begun but not completed in 1907 but excluding the completion of 1906 work, thus amounts to 119.39 miles. The length of roads surveyed for improvement in 1908 aggregates 106.22 miles.

A NEW PORTABLE RIVET-HEATING FURNACE, manufactured by the Rivet, Bolt & Nut Co., of Glasgow, Eng., is of the revolving type. The difficulty experienced with furnaces hitherto built after similar designs, is that part of the rivet having been exposed to the atmosphere during heating, its temperature is not even at all parts and it will not thoroughly fill the hole when riveted up. The new heater avoids this trouble as it is closed on all sides except a small portion of the front which is open for the operations of the attendant. This closed construction also conduces to a saving in fuel especially when the number of rivets required is small. Its other features of blast, ash-receiver, etc., conform to usual practice. According to the "Iron & Coal Trades Review" of London, May 29, the furnace is now in successful use by a number of leading British firms.

PERSONALS.

Mr. T. F. Salter, M. Am. Soc. M. E., has been appointed Chief Engineer of the Standard Roller Bearing Co. of Philadelphia, Pa.

Mr. H. J. Armstrong has been appointed Assistant Professor of Civil Engineering in the Armour Institute of Technology, Chicago, Ill.

Lieutenant William G. Caples, Corps of Engineers, in addition to his other duties, has been detailed as assistant to the engineer of the Seventh and Eighth light-house districts.

First Lieutenant Charles R. Pettis, Corps of Engineers, has been appointed Chief Engineer Officer of the Department of Columbia, relieving Col. Solomon W. Roessler, Corps of Engineers, of that duty.

Mr. Edson J. Davis, of New Jersey, has been appointed engineer on the construction of the great aqueduct whose completion, expected in about five years, will inaugurate a new system of water supply for Los Angeles, Cal.

Mr. Erwin E. Haslan, formerly resident field engineer of the Niagara Falls Hydraulic Power & Mfg. Co., at Niagara Falls, N. Y., has been appointed Resident Engineer of the Northern Division of the N. Y. State Water Supply Commission, with headquarters at Tupper Lake village.

Mr. W. A. Aiken, M. Am. Soc. C. E., for the past eight years General Inspector of Material on the staff of the chief engineer of the Board of Rapid Transit Railroad Commissioners of New York City, has become associated with the Henry S. Spackman Engineering Co., 42 North 16th St., Philadelphia, Pa.

Mr. Mason R. Strong, M. Am. Soc. C. E., formerly Bridge Engineer of the Erie R. R., who has been engaged in private engineering practice for some time, has taken the architectural and engineering practice of the late W. Wheeler Smith and will continue the business at his present offices, No. 7 Wall St., New York City.

Messrs. H. W. Edwards, M. Am. Soc. C. E., and Morris A. Zook, M. Am. Soc. C. E., have recently completed a physical and real estate valuation of the entire New York, New Haven & Hartford R. R. system for Mr. John F. Stevens. They have opened offices for general engineering practice in the Fulton Bldg., Hudson Terminal, New York City, and will make a specialty of railway appraisal work.

Prof. Charles Durtin Bray, for 39 consecutive years Professor of Mechanical and Civil Engineering at Tufts College, Medford, Mass., has resigned and will devote his time to private research and travel. Prof. Bray graduated from Brown University in 1864 and went to Annapolis, from which he graduated in 1868 at the head of his class. He was third assistant naval engineer when he left the service to accept the professorship at Tufts.

Mr. Alfred C. Bothams, Assoc. M. Inst. C. E., of Salisbury, England, recently received handsome testimonials in honor of the completion of his term of service as City Engineer and Surveyor of Salisbury. As noted in our issue of May 28, 1908, Mr. Bothams and his father before him filled the office named for more than 50 years. One of the testimonials received by Mr. Bothams was a silver rose-bowl given by 80 or 90 of the city employees who had served under him. Another was a gold watch engraved with the city coat of arms. The latter was presented by members of the City Council and Mr. Bothams' fellow officials.

Obituary.

John B. Roach, President of the Delaware River Iron Shipbuilding & Engine Works, and son of John Roach, often referred to as the father of the American navy, died at his home in Chester, Pa., at the age of 68. Mr. Roach was a member of the Engineers' Club of New York City.

Frederic C. Warman, M. Am. Soc. C. E., First Assistant Engineer in the Engineer Office of the War Department, died suddenly at Norfolk, Va., April 27, at the age of 36. He was a graduate of Lehigh University, class of '93. At the time of his death Mr. Warman was in charge of the construction of the defences of Forts Washington and Hunt, near Mt. Vernon, and of the Potomac river and harbor improvements.

Peter H. Jackson, head of the firm of P. H. Jackson & Co., Inc., of San Francisco, and an expert in steel construction, well known on the Pacific Coast, died at his home in Oakland, Cal., June 17, at the age of 78 years. He was at one time prominent in public life in New York City. At the outbreak of the Civil War he was running the largest foundry in New York, and for some time filled large government contracts for [illegible] shells for the federal artillery.

William B. Leeds, at one time [illegible]dent of the Chicago, Rock Island & Pacific Ry [illegible] from which position he retired in 1904, died sudd[illegible]n Paris, June 22. Mr. Leeds was born at Richmo[illegible]nd., in 1851, where he began business as a florist. [illegible] his marriage in 1883, he entered the service of the I[illegible]sylvania R. R. advancing to a division superintende[illegible]. He then took up the tinplate industry and develo[illegible] with large profit up to the time of the amalgama[illegible] of the Ameri-can Tin Plate Co. with the U. S. Steel [illegible]oration. Since then his activities have extended ov[illegible]wide field of railway, power, gas and trust busine[illegible]

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN SOCIETY OF CIVIL ENG[illegible]ERS.
June 23-26. Annual convention [illegible]nver, Colo. Secy., C. W. Hunt, 220 West 57th [illegible], New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 23-26. Annual convention at [illegible]troit, Mich. Secy., C. W. Rice, 29 West 39th [illegible], New York City.

SOCIETY FOR THE PROMOTION OF [illegible]GINEERING EDUCATION.
June 23-26. Annual meeting at D[illegible]t, Mich. (In connection with convention of Am[illegible]n Society of Mechanical Engineers.) Secy., A. [illegible] Williston, Pratt Institute, Brooklyn, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 23-27. Annual meeting at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 29-July 2. Annual convention at Atlantic City, N. J. Secy., Ralph W. Pope, 33 West 39th St., N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 24-25. Summer meeting at Niagara Falls, N. Y. Secy., W. M. Mackay, P. O. Box 1818, New York City.

IRON AND STEEL INSTITUTE.—The autumn meeting of this society will be held at Middlesbrough, Eng., Sept. 28-Oct. 1.

AMERICAN INSTITUTE OF MINING ENGINEERS.—A meeting will be held at Birmingham, Ala., beginning Sept. 29. After the meeting there will be an excursion by a special train to Chattanooga, Ducktown and Cincinnati, returning by way of Pittsburg to New York. This trip will occupy about a week.

LAKE SUPERIOR MINING INSTITUTE.—The thirteenth annual meeting of this society is now being held, June 24-27, on the Minnesota Ranges. The papers prepared for this meeting are: "Sampling of Iron Ores," by Prof. L. S. Austin, Houghton, Mich.; "Biographical Sketches," by Mr. J. H. Hearding, Eveleth, Minn.; "The Standard Boiler House of the Oliver Iron Mining Co.," by Mr. A. M. Gow, Duluth, Minn.; "Automatic Throttle Closing Device for Hoisting Machinery," by Mr. Spencer S. Rumsey, Duluth, Minn.

AMERICAN FOUNDRYMEN'S ASSOCIATION.—This society and its affiliations—the Associated Foundry Foremen, the Brass Founders' Association and the Foundry Supply Association, held their annual convention at Toronto, Can., June 9-12. A feature was the display made by the supply men of mechanical devices and founding processes in actual operation. The officers are: American Foundrymen's Association, Pres., Stanley G. Flagg, Jun. M. Am. Soc. M. E., of Philadelphia, Pa.; Sec., Richard Moldenke, M. Am. Soc. M. E., Watchung, N. J.; American Brass Founders' Association, Pres., Chas. J. Caley, M. Am. Soc. M. E., New Britain, Conn.; Sec., A. M. Fairlie, Copperhill, Tenn.; Foundry Supply Association, Pres., E. H. Mumford, M. Am. Soc. M. E., Philadelphia, Pa.; Sec., H. M. Lane, M. Am. Soc. M. E., Cleveland, O.; Associated Foundry Foremen, Pres., James Webb, Davenport, Ia.; Sec., F. C. Everitt, Trenton, N. J. Mr. Lane is in charge of the exhibits.

CANADIAN ELECTRICAL ASSOCIATION.—The eighteenth annual convention was held at Toronto, Canada, June 17-19. The following papers were on the program: "Power Rates and Factors which Influence Them," by Mr. W. N. Ryerson; "How to Increase the Station Load," accompanied by lantern slides, by Mr. George Williams; "Lost and Unaccounted for Current," by Mr. C. R. McKay; "Electrical Plant Earnings Per Capita," by Mr. W. A. Bucke; "Various Electrical Power Plants by European Designers," by Mr. C. H. Mitchell; "Modern Street Lighting," by Mr. A. E. Fleming; "Regulation of Electric Currents or Circuits," by Mr. W. G. Chace; "Various Distributing Systems Adapted to Cities and Towns," by Mr. R. G. Black; "Electrical Franchises, their Legal Status and Basis of Valuation," by Mr. Jas. Bicknell; "Contracts," by Mr. Robert McKay; "Grounding of Transformer Secondaries," by Mr. W. L. Macfarlane; "The National Electrical Code," by Mr. H. F. Strickland; "The Oscillograph," illustrated with slides and instruments, by Mr. H. W. Price.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, June 25, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work.	Place.	See issue.
6-27	*Concrete wall	Riverton, Ala ..... (S.)	5-28
6-27	Steel floats	Newport, R. I. ..... (S.)	6- 4
6-29	*Filters, etc.	Pittsburg, Pa. ..... (P. & S.)	6-18
6-30	*Dredging, rock removal	New York, N. Y. ..... (S.)	6-11
6-30	*Garbage plant	Mont Alto, Pa. (S.)	6-25
6-30	*Paving	Ada, Ohio ..... (S.)	6-25
6-30	*Sewers	Plainfield, N. J (P. & S.)	6-25
7- 1	Cast-iron pipe	Pensacola, Fla. (S)	6-25
7- 2	*Retaining wall	Wilmington, Del. ..... (P. & S.)	6-18
7- 3	Levee	Bledsoe, Ark ..... (S.)	6-18
7- 3	Dredging, etc.	Bremerton, Wash. ..... (S.)	6-11
7- 6	*Road	Salem, N. J ..... (P. & S.)	6-25
7- 7	Ditch	Glenwood, Minn. ..... (S.)	6-25
7-8	Power-house	Bremerton, Wash. ..... (S.)	6-11
7- 8	*Levee	Vicksburg, Miss. ..... (S.)	6-11
7- 9	Shop	Phila., Pa. (Mfg. Pl.) (S.)	6-11
7-11	Ash-handling	Phila., Pa. ..... (S.)	6-11
7-11	Derrick	Bremerton, Wash. ..... (S.)	6-25
7-13	*Lock, dam	Vicksburg, Miss.. (S.)	5-14
7-15	*Channel	Sunnyside, Wash..(S.)	6- 4
7-15	*Steel gates	Nashville, Tenn. ..... (P. & S.)	6-18
7-18	Bridge	Dayton, Ohio.....(P. & S.)	6-25
7-18	Dry dock	Bremerton, Wash. (S.)	6-11
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7- 6 Sale of plant, Valley City, N. D.. 6-11
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7-18 Gas wells, Medicine Hat, Alta.... 6-25
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6-26 Substructure, Buffalo, N. Y. 6-18
6-26 Bridges, Mitchell, S. Dak 6-18
6-27 Bridge repair, Richmond, Ind.... 6-18
6-27 Substructure, Findlay, Ohio..... 6- 4
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6-27 Bridge, Mifflintown, Pa..... 6-25
6-29 Bridge, Hollidaysburg, Pa..... 6-25
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6-29 Bridge, Dresden, Ohio 6-18
6-29 Bridge, Allentown, N. J. 6-18
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7- 1 Bridges, Somerset, Pa. 6-18
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7- 1 Arch, Cleveland, Ohio 6-11
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7- 6 Bridges, Greenwood, Miss. 6-18
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7- 7 Bridges, Jasper, Ind..... 6-25
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7- 9 Bridges, Anderson, Ind..... 6-25
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7-14 Bridges, Fargo, N. Dak..... 6-25
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6-29 *City hall, Massillon, Ohio 6- 4
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6-29 Infirmary, Mont Alto, Pa..... 6-25
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7- 6 *Roof, Canton, Ohio 6-18
7- 6 Cottage, Delaware, Ohio 6-18
7- 6 Post-office, Marietta, Ga..... 5-28
7- 6 Hall, San Jose, Cal..... 6-11
7- 6 Schools, New York, N. Y..... 6-25
7- 7 Bank, Jacksonville, Fla..... 6-25
7- 7 *Cottages, Newark, N. Y..... 6-11
7- 8 Cement plant, Burrwood, La. (Mfg. Pl.) 6-18
7-16 Ice plant, Ft. Dade, Fla.(Mfg. Pl.) 6-25
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6-29 *Sewer, Washington, D. C..... 6-11
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7- 1 Sewer, Dillon, Mont..... 6-25
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7-22 Elec. Engr.-Mech. Draftsman, Washington, D. C..... 6-11

RAILWAYS.

ALBERTA SOUTHWESTERN.—Application for a charter has been made by Mayor J. J. Carrick, James J. O'Connor, James A. Little, J. A. Crozier and W. S. Ruttan, all of Port Arthur, Ont. They propose to build a line from a point on the international boundary at or near the Kootenay River up the valley to Elko, B. C., thence northeasterly following the valley of the North Kootenay River and the South Fork of the Old Man River to Cowley, Alberta; thence to the Livingstone range to Highwood River and on to Calgary. The capital stock of the company is to be $1,000,000 and the bonding power is to be $40,000 per mile. The head office of the company is to be at Port Arthur.

ALEXANDRIA, LEESVILLE, LUFKIN & WESTERN.—We are officially advised that surveys are now being made by a party in charge of L. F. French, Ch. Engr., between Leesville and Alexandria. The promoter is Mike O'Brian, of Leesville. Company will build and operate a standard-gage line from Alexandria, La., through the Parishes of Rapides and Vernon by way of Leesville to the Sabine River, thence across this river and through the Counties of Newton, Jasper Angelina in the state of Texas to Lufkin, Tex. Capital stock, $1,000,000. The incorporators and officers are as follows: Mike O'Brian, Pres.; J. E. Duff, Treas.; T. J. Davis; D. M. Sholars; J. J. Hicks, Second Vice-Pres.; T. C. Wingate, First Vice-Pres.; N. M. Palmer, M. D.; Horace White; W. K. Ferguson, Third Vice-Pres.; G. H. Schweitzer, Secy. Headquarters are at Leesville, La. Noted on May 28.

CALIFORNIA.—The Supervisors of Los Angeles County have passed an ordinance granting permission to the City of Los Angeles to build and maintain for a period of five years a temporary steam railroad on the county road between Mojave and Red Rock canyon. The permission was granted on the filing of a favorable report of the committee of supervisors and the county surveyor who visited the line of the proposed road.

The City of Los Angeles was also granted permission to construct and maintain an aerial tramway across the county road in section 30, 32-34.

CANADA.—The German Development Co. is making surveys for a 100-mile line from Innisfail, Alberta, to its coal fields. M. P. Bellechase, Ottawa, Ont., is interested.

FLORIDA.—Bids are asked until 11 a. m., July 1, by Capt. D. W. Hand, Constructing Q. M., Fort Barrancas, Fla., for material and labor required in repair and extension of railroad tracks at this post.

We are officially informed that the Bureau of Yards and Docks, Navy Dept., has placed in the hands of the Public Printer, specifications for the construction of a marine railway at the Naval Station, Key West, Fla. The railway is to be about 693 ft. long with two lines of rails, and stringers 12 ft. apart, resting on pile foundation. The cradle will be about 162 ft. in length and will travel on rollers over the inclined track. Hauling out machinery and a house to cover the same are included. The contract will allow twelve calendar months for the completion of the work. The appropriation available is $18,500. Plans and specifications should be ready for distribution in about ten days.

DELAWARE, LACKAWANNA & WESTERN.—We are officially advised that contracts have been awarded as follows for the construction of a new cut-off between Lake Hopatcong and the Delaware Water Gap, which will reduce the distance between Jersey City and Buffalo by ten miles, and give the Lackawanna a low grade line through the New Jersey hills: Section 1, TIMOTHY BURKE, Scranton, Pa.; Section 2, WALTZ & REECE, Billings, Mont.; Section 3, D. W. FLICKWIR, Terry Bldg., Roanoke, Va.; Section 4, W. H. GAHAGAN, 189 Montague St., Brooklyn, N. Y.; Section 5, HYDE-McFARLAND CO., 7 East 42d St., New York; Section 6, REITER, CURTIS & HILL, Arcade Bldg., Philadelphia; Section 7, SMITH & McCORMICK, Easton, Pa. According to the New York "Times," the cost of the new line will reach $10,000,000, making it the most expensive piece of railroad building other than terminal work, ever undertaken in this country. The new cut-off, which will run from Hopatcong, N. J., to Portland, on the Delaware River, will be 28 ½ miles long, and as it will cost $10,000,000 the expenditure will amount to about $350,000 a mile. Lincoln Bush is Ch. Engr., Hoboken, N. J. Previously noted.

EAGLE VALLEY.—Construction will begin soon on this railway. It will be narrow-gage, extending from Baker City, Ore., to a rich mining district 70 miles into the interior, where it will tap the Eagle and Pine valleys, and the copper country northwest of Baker City in the Cornucopia Mountains. A. B. Jacobs, Cincinnati, Ohio, is the promoter.

EL PASO & SOUTHWESTERN.—Improvements to cost about $100,000 will be made this summer on the eastern division of this railway. POWERS & O'CONNOR, of El Paso, Tex., have the contract. H. J. Simmons is Gen. Mgr., El Paso.

GEORGIA, SOUTHWESTERN & GULF.—Company will issue $4,000,000 of stock and $4,000,000 of bonds for its proposed line from Dawson, Ga., through Terrell, Calhoun, Dougherty, Baker, Miller and Decatur Counties, Ga., to a point on the Gulf coast in Florida, 155 miles. W. M. Legg is Pres., H. A. Bruton, Secy., both at Dawson, Ga.

GRAND TRUNK PACIFIC.—The following sub-contracts have been let by FOLEY, WELCH & STEWART, of Winnipeg, Man., on their 100-mile section eastwards from Prince Rupert, B. C.: NEIL KEITH, Winnipeg, three miles; McDONALD & McALISTER, Edmonton, Alta., five miles; M. SHADY, Winnipeg, three miles; SMITH BROS., Kenora, Ont., three miles; HARSTONE & STAINOR, three miles. Other subcontracts will be let shortly.

INTEROCEANIC RY. OF MEXICO.—It is announced that heavy grades and sharp curves on this railway will be removed and new stretches of roadway will be constructed with the view of changing the track from narrow-gage to standard-gage width at some future time. The construction of a new section, about 12 kilometers long, extending west from La Viga, will relieve it of one of the heaviest grades, on which many serious accidents have occurred, and on which only light trains could be moved. Work also is in progress at other places on the Interoceanic, and the bad stretches of track are to be improved, one by one, until the whole road is finished and ready for the changing of the gage to standard width. The Interoceanic belongs to the Government merger system and runs between Mexico City and Vera Cruz, 339 miles.

MARYLAND & PENNSYLVANIA.—Contract has been awarded by the Maryland & Pennsylvania R. R. Co. to JOHN F. POTTS & SONS, contractors, 109 West Clay St., Baltimore, for the grading of the old Harris property, on the Falls road, for terminals. Work will be started in a few days.

MISSOURI, OKLAHOMA & GULF.—This railway will be extended at once from Lamar, Okla., the present terminal, to Calvin, on the Canadian River, in Hughes County. E. B. Fisher, Gen. Supt., Muskogee, Okla.

TEXAS & PACIFIC.—Plans have been prepared by company's engineers for the building of the town of Addis on the outskirts of Baton Rouge Junction, where the low grade St. Louis line of the Texas & Pacific connects with the line to Shreveport and El Paso. The company will spend $500,000 in the improvements which have already been mapped out. These include modern shops and a 40-horse-stall roundhouse, office buildings and residences for employees. Car yards will also be laid out. The company expects to employ about 1,500 men in the shops, roundhouse and yards at the start, and more as the necessity arises. The town is to be named Addis in honor of J. W. Addis, Supt. of Machinery of the Texas & Pacific, whose headquarters are now at Marshall, Tex. The town will be the mechanical headquarters for Louisiana of the Texas & Pacific lines to Ferriday and Shreveport. Work will begin, according to present plans, during the coming fall.

WEST SIDE BELT R. R.—On June 22 this company was placed in the hands of receivers, the Wabash R. R. Co. making the request. The United States Court before which the petitioners appeared, granted the petition and appointed as receivers, Frank H. Skelding and H. W. McMasters, who are already receivers for the Wabash-Pittsburg Terminal. The Wabash R. R. Co. put in a claim for $106,000, balance due on a note given July 1, 1906. See June 4.

ELECTRIC RAILWAYS.

ONEONTA, N. Y.—The Oneonta & Mohawk Valley R. R. Co.'s property has been placed in the hands of a receiver. Joseph K. Choate, Gen. Mgr. of the company, has been appointed receiver. Company operates 80 miles of railroad, connecting Oneonta, Cooperstown, Richfield Springs and Mohawk.

NEW YORK, N. Y.—The New York Public Service Commission, First District, has adopted a resolution providing for valuation of the property of the street railway companies in Manhattan. The passage of the resolution followed the admission by the receivers of the New York City Railway of the necessity for further abolition of transfers and of the inability to comply with certain orders of the commission for increased service if obligations for rentals on leased lines are to be met. Oren Root, Mgr.

FLUSHING (L. I.), N. Y.—Extension of the New York & Queens County Ry. from Flushing to Whitestone and to Bayside were authorized by the New York Board of Estimate on June 19. For two years its applications have been pending before the board. One extension will run from Broadway and Main St., Flushing, to Eleventh Ave. and 30th St., Whitestone, and the other from Franconia Ave. and 22d St., Flushing, to Broadway and Bell Ave., Bayside. F. L. Fuller is Pres., Gen. Mgr. and Pur. Agt., 9 Borden Ave., Long Island City, N. Y.

BUTLER, PA.—R. H. Boggs, Pittsburg, Pres., in an official statement, sets July 4 as the date when the Pittsburg, Harmony, Butler & New Castle St. Ry. will be opened between Butler and New Castle. Cars will be run from Ellwood City to Butler by July 1.

OAKLAND, MD.—Construction work will be undertaken soon by the Youghiogheny Light & Power Co. on its proposed standard-gage electric railway. The road will be about 12 miles in length and it will reach Swallow Falls, Oakland, Mt. Lake Park and Deer Park. The overhead trolley system will be used. The company proposes to operate amusement parks along the line. Capital stock, $200,000. Officers: A. G. Sturgiss, Pres.; Truman West, Vice-Pres.; Bowie Johnson, Secy.; James D. Hamill, Treas.; H. P. Tasker, Oakland, Gen. Mgr.; J. B. Hogg, Connellsville, Pa., Ch. Engr. Noted on May 28 and May 14.

WHEELING, W. VA.—The Wheeling Traction Co. may extend its line to Moundsville this summer. H. O. Nagle is Supt.

MEMPHIS, TENN.—H. E. Craft, Vice-Pres. of the Lake View Traction Co., Memphis, advises us that contracts probably will be let within the next 30 days. Company proposes to build an electric line from Memphis to Lake View, Tenn., and Clarksdale, Miss., 77 miles. Also from Memphis to Collierville, 28 miles; from Memphis to Covington, 33 miles; and 15 miles within city limits of Memphis. Surveys are made and right-of-way secured. Capital is obtained. R. F. Tate is Pres.; W. W. Hayden is Ch. Engr., Memphis.

PADUCAH, KY.—The Kentucky River & Ohio River Interurban Ry. Co. has awarded the contract for grading its line to SIMMS BROS., of Thebes, Ill. Contract for 18 bridges has been let to FORBUSH & STOTLER, of Benton, Ill. The WESTERN ENGINEERING & CONSTRUCTION CO., 605 Globe Bldg., Minneapolis, has the general contract. John J. Freundlich, Paducah, is Gen. Mgr. Noted fully on May 7 and May 14.

CLEVELAND, OHIO.—The Wheeling & Western Traction Co. has not yet awarded contracts for building its proposed railway, which will connect Wheeling, W. Va., with several places in Ohio, including Uhrichsville, Bridgeport, Martins Ferry, Cadiz, Colerain, Harrisville, Jewett, Bowerston and Scio, about 40 miles in length. A. E. Townsend, of Cleveland, Ohio, is Pres. Noted on June 4.

SOUTH CHARLESTON, OHIO.—The Springfield & Washington Ry. Co. (successor to the Washington Traction Co. of Springfield, Ohio), will begin construction soon on its extension from South Charleston to Washington Court-house. G. W. Baker is Pres.

VINCENNES, IND.—We are officially advised that the Vincennes, Centralia & St. Louis Transit Co. has been incorporated to build an electric railway from a point on the east line of the State of Illinois, in Lawrence County, opposite Vincennes, Ind., through the counties of Richland, Clay, Marion, Clinton, Bond, and to a point in St. Clair or Madison Counties opposite the city of St. Louis, Mo. General offices of the company are at 705 Isabella Bldg., Chicago. The incorporators are M. A. Peoples, J. J. Burns, Clyde F. Burns, Dennis O'Connor and J. E. Burns, all of Chicago. Capital stock is $30,000, but it is to be immediately increased. Burns & Co., 705 Isabella Bldg., Chicago, are retained in a consulting capacity for this company and will have entire charge of construction and award all contracts.

The Vincennes & Washington Transit Co. has commenced construction on its proposed standard-gage railway system, to be 21 miles in length, which will connect Vincennes, Monroe City, Wheatland and Washington. The motive power is to be both steam and electricity. Capital stock, $60,000. J. J. Burns, 705 Isabella Bldg., Chicago, Ill., is Pres. and Pur. Agent; M. A. Peoples, Monroe City, Ind., Vice-Pres. and Supt. Headquarters, 705 Isabella Bldg., Chicago, Ill. Noted fully last week.

WOOD RIVER, ILL.—We are officially informed that the Wood River, East Alton & Bunker Hill Traction Co.'s projected line will extend from Wood River to Bunker Hill, Ill., via East Alton and Bethalto, 19 miles. Surveys have been made and right-of-way partly secured. Sheppard & Morgan, Edwardsville, Ill., are the Engrs. J. T. W. Rudesill, East St. Louis, Ill., is Pres. Noted fully on May 28.

WOODSTOCK, ILL.—The Northeastern Electric Ry. Co. was incorporated on June 11 in Illinois to construct an electric railway from Woodstock, through the counties of McHenry and De Kalb to Sycamore, De Kalb County Principal office, Chicago. Capital stock, $50,000. Incorporators: Clinton G. Lumley, E. C. Spinney, Irving D. Stevens, E. B. Harang, F. H. Rhodes, William L. Abbott, George W. Lyndon, George T. Goodrow, Charles A. Spenney, L. C. Winans, B. J. Simpson, M. A. Garrett, B. E. Livingston, E. P. Starmiberg and Darius A. Leland.

As noted on April 23, "the Woodstock & Sycamore Traction Co. has been incorporated in Illinois to build an electric railway from Woodstock, McHenry County, to Sycamore, De Kalb County, Ill., 38 miles. Incorporators are Clinton G. Lumley, E. C. Spinney, Irving W. Stephens, E. B. Harang, S. H. Rhodes, William L. Abbott, George W. Lyndon, George T. Goodrow, Henry P. Heiser, N. G. Schmitz and Charles A. Spenney. It is officially announced that construction will be started this summer. The power station and repair shop will be built at Marengo, Ill. The company has a capital stock of $1,000,000, of which $25,000 has been issued. Bonds have also been authorized to the amount of $1,000,000. The officers are as follows: E. B. Harang, 1210 Tacoma Bldg., Chicago, Ill., Pres.; E. C. Spinney, 501 Chicago Savings Bank Bldg, Vice-Pres.; Chas. A. Spenny, 1210 Tacoma Bldg., Chicago, Ill., Secy. and Treas.

SIOUX CITY, IOWA.—F. W. Bisbee, Castana, Iowa, advises us that he is interested in plan to build an electric railway to be known as the Sioux City, Council Bluffs and Omaha Ry., from Sioux City to Council Bluffs and Onawa, Iowa, to Dunlap, Iowa, a total of 130 miles.

WAHPETON, N. DAK.—F. R. Barnes, Secy. of the Commercial Club, wishes to communicate with parties in regard to a proposition to build an electric railway in Wahpeton, exending 50 miles from Wahpeton to Sisseton, it is reported. It is stated that "there is available water-power for generating purposes and the community is well settled and prosperous, almost entirely agricultural."

EXCELSIOR SPRINGS, MO.—W. A. J. Bell, of Excelsior Springs, Vice-Pres. of the Excelsior Springs & Suburban Ry. Co., informs us that contracts will be let at once for building the proposed line from the Chicago, Milwaukee & St. Paul Railroad depot near Excelsior Springs to a point in the central portion of Excelsior Springs, a distance of about 1½ miles. Company expects to build its power station and repair shop in this city. Capital, authorized and issued, $50,000. General office, Excelsior Springs. Officers: W. A. Bell, London, Eng., Pres.; W. A. J. Bell, Excelsior Springs, Mo., Vice-Pres. and Pur. Agent; J. E. Lundstrom, Colorado Springs, Colo., Secy. and Treas.; W. P. Southard, Excelsior Springs, Supt. and Elec. Engr.; B. Van de Greyn, Excelsior Springs, Ch. Engr. Surveys have been made and capital secured. Franchise has been granted.

UVALDE, TEX.—A franchise has been granted to M. M. McFarland of San Antonio, Tex.; J. C. Kirbey and John T. Smith, of Austin, Tex., for a street railway, construction to begin within four months. Line is to be two miles long and will be operated by gasoline motor cars.

GOLDEN, COLO.—Rees C. Vidler and other Denver capitalists are interested in a plan to build an electric railway from Golden to the top of Mount Lookout.

GRAND JUNCTION, COLO.—Morris K. Devereaux and Eugene S. Sunderlin will apply for a franchise to construct a street railway in Grand Junction.

CANON CITY, COLO.—W. O. Bourne, Pueblo, Colo., Treas. of the Kansas-Colorado R. R. Co. and the Kansas-Colorado Electrical Transmission Co, advises us that construction contracts will be let as soon as surveys are completed and it is probable that the work will go on rapidly. Right-of-way has not been secured. Surveys are now under way. The line will extend from Canon City to Pueblo and Dodge City, Kan., with a branch line from Garden City, Kan., to Scott City, Kan., 350 miles in length. A. H. Atwater, Canon City, is Pres. Capital of each company is $5,000,000. C. W. Davis, Ben. L. Allen and J. S. Greene are the Engrs. Headquarters have been located in Pueblo.

SEATTLE, WASH.—The Seattle, Snohomish & Everett Ry. Co. has applied to the county commissioners for a franchise to construct an electric railway from the Seattle city limits and the town of Bothell over the King County roads. C. W. Kimball, Pres. Noted on June 4.

WOODBURN, ORE.—The Valley Ry. Co., recently incorporated, has started construction on its line. Company will build a standard-gage electric railroad from West Woodburn to Woodburn, three miles, and thence through Monitor to Scotts Mills, and on up into the foothills to Wilhoit Springs. A branch will be extended from Monitor to Silverton. Total length, 25 miles. Capital stock, $100,000. Frank Robertson, Portland, is Pres.; Wm. S. Turner, Vice-Pres. W. S. Barstow & Co., Portland, Ore., are Engrs.

MONTREAL, QUE.—We are officially advised that the Montreal & Southern Counties Electric Ry. Co. has opened offices at 605 and 606 Canadian Express Bldg., McGill St., Montreal. W. B. Powell is Mgr.; J. A. Burnett is Supt. and Elec. Engr. Work is now proceeding on the Montreal-St Lambert section of this road, and entry into the city of Montreal has been arranged for.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

CLINTON, MASS.—The J. W. BISHOP CO., 107 Foster St., Worcester, Mass., has been awarded the contract to build the new power-house for the Bigelow Carpet Co. The building will cost about $140,000, and when equipped as the main power plant for the company's mills, will cost nearly $500,000. We are officially advised that the plans call for brick buildings comprising a power-house 102 × 63 ft.; a boiler house, 197 × 50 ft.; a coal pocket, 197 × 70 ft., and a pump-house, 48 × 27 ft. The roofs are to be of plank, tar and gravel except that over the power-house, which is to be of concrete and plastic slate. Coal is to be conveyed from the Boston & Maine R. R. tracks by a double track underground tunnel passing under Main St., the latter to be raised to permit of this arrangement. Midway between the coal pocket and boiler-house will be the brick boiler stack 200 ft. high with a 10-ft. flue. The equipment will consist of two electrical units, one of about 750 KW. and the other of about 350 KW. Six 84-in. × 19-ft. boilers are to be added to the eight old boilers of the same size. Two fire pumps, and four feed pumps, complete the power outfit. Pipe tunnels will connect the boiler-house with the dye-house, and the power-house with the weave mill, the former for steam piping and the latter for electric power cables. Charles T. Main, 45 Milk St., Boston, Mass., is Engr.

NEW YORK, N. Y.—Bids are asked until 11 a. m., July 6, by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, for alterations and additions to electric equipment in Public School No. 81, on 119th and 120th Sts., near Seventh Ave., Boro. of Manhattan; for alterations and additions to the electric equipment in Jamaica Training School, and Public Schools Nos. 7, 14, 20, 27, 31, 31, 47, 72, Boro. of Queens.

PITTSBURG, PA.—The contract for the complete electrical installation of the Carnegie Technical Schools is reported to have been awarded to W. H. OCHILTREE CO., 210 Third Ave., Pittsburg, about eight miles of iron co[nduit] miles of wire, and two main switchboards.

WASHINGTON, D. C.—Bid[s] as follows June 18 at the o[ffice] R. Green, Supt. of Construct[ion] National Museum Building, D. C., for furnishing the e[lectric] namos for the new building: Co., Elizabethtown, N. J., en[gine] 500; Providence Engineering [Co.] R. I., (e) $15,000, dynamo; Wallace Stebbins & Sons, B[oston] $25,462, $24,533; Ridgway [Dy]gine Co., Ridgway, Pa., (e) $10,770; Westinghouse Electric Baltimore, (d) $8,795; General Schenectady, N. Y., (d) $9,5[00]; neering & Mfg. Co., Mattoon 500, $12,750; Burke Electric (d) $8,790; Ball Engine Co. (e) $13,817; Northern Electric Madison, Wis., (e) $11,340, $50, $13,400.

ANDERSON, S. C.—W. H. of Biloxi, Miss., who has se[cured] for gas works at Anderson, [S.] plant during summer and fall.

HUNTSVILLE, ALA.—Engi[neers] work on locations for dams [on] Shoals Hydro-Electric Co. It construct a power plant at the Tennessee River, with 200,000 HP.

RUSSELLVILLE, ALA.—The [City] voted to issue $24,000 in bond[s] struction of an electric light pl[ant] works system.

MONTVALE, TENN.—The A[CME] TRIC CO., of Knoxville, Ten[n.] awarded a contract for a 200-[kw.] plant at Montvale Springs. Hen[ry] is Mgr. of the Acme Electric Co.

RICHMOND, KY.—We are [officially] advised that bids will be receive[d about July 20 for constructing a steam [heating] plant for the Kentucky Eastern Normal School, Richmond. Estimated cost, $25,000. Anderson & Frankel, State University, Lexington, Ky., are Engrs.

FREMONT, OHIO.—We are officially advised that the hydro-electric development at this point which was deferred last year on account of the general financial depression, is to be started at once. The owners have engaged H. von Schon, Wayne County Bank Bldg., Detroit, Mich., to prepare plans and specifications.

GARRETT, IND.—The city is contemplating making improvements to the municipal electric lighting plant, the cost of which is estimated at $15,000. R. S. Ashe, of Richmond, Ind., is Engr. William Watson is City Clerk.

NEWCASTLE, IND.—Press reports state that the management of the Newcastle Light, Heat & Power Co. will build a gas plant here to cost $40,000. A franchise has been secured to furnish gas.

CADILLAC, MICH.—The Village Council is contemplating rebuilding the dam on Cedar Creek, which was recently destroyed, to furnish power to operate the municipal electric light plant.

*TRAVERSE CITY, MICH.—Bids are asked until 2 p. m., July 15, by the Boardman River Electric Light & Power Co. at Traverse City, for raising the "Upper Dam" from its present head of 22 ft. to a head of 41 ft. W. S. Cook, Traverse City, is Gen. Mgr.

MARSEILLES, ILL.—The Marseilles Land & Water Co. intends to build a transmission line west to Ottawa during the coming year, it is stated.

MANITO, ILL.—GEORGE H. GLASS & CO., of Pekin, has secured the contract for the electric light plant to be built at Manito, at $3,075.

*STURGEON BAY, WIS.—Bids are asked until 8 p. m., July 7, by H. C. Leonhardt, City Clerk, for constructing an electric light plant and water-works system.

GENOA, NEB.—We are officially advised that the Village Council has employed John W. Early, Columbus, Neb., to prepare plans, etc., for the proposed municipal electric lighting system, to be installed at a cost of $11,000. The equipment yet to be purchased includes a 30-HP., 3-phase, 60-cycle, 220-volt motor, alternating current; and transformers of various sizes.

SEWARD, NEB.—Contracts for furnishing material and equipment for the addition to the municipal electric light system have been awarded to FILER & STOWELL CO., of Milwaukee, Wis., and the WESTINGHOUSE ELECTRIC & MFG. CO., of Pittsburg, Pa. J. Martz is Engr.

SEATTLE, WASH.—Bids were received June 23 by James Knox Taylor, Supervising Arch., Treasury Dept., Washington, D. C., for electric wiring at Seattle, Wash. The lowest bid of the six received was that of the Empire Electrical Co., Seattle, at $7,100.

SEATTLE, WASH.—On June 3 the Regents of the University of Washington awarded the contract for the university power-house and plant. The award for the construction of the power-house was made to H. CHASE & CO., for $16,557. The walls of the building will be paved with brick and the roof will be of slate. The HALLIDIE MACHINERY CO., 315 Second St., South Seattle, secured the contract for the apparatus to be installed in the building, at $72,900. Noted on June 18.

TACOMA, WASH.—It is reported that the Current Power Co. will make a proposition to the City Council to install a power plant in the Narrows, similar to the one at Strumpfs Rapids. J. H. Boothroyd, Secy., has stated that the plant will furnish 10,000 HP. and can be installed for 250,000.

OAKLAND, CAL.—The Great Western Power Co., Crocker Bldg., San Francisco, and 115 Broadway, New York, has let a contract to the GLOBE CONSTRUCTION CO. for the

erection of a transformation sub-station on a triangular ... of land bounded by White and King ... and Fourth Ave., in East Oakland. ... sub-station which will be built at White ... ing Sts. is to be a brick structure ... ental design, and machinery ture of ... for the transformation of will be ... the Big Bend plant on the the power ... A subway, one mile in Feather ... nect the sub-station and the length, ... use at the foot of Fifth Ave. steam pow... announced that the company It has ... seven acres of land on Sesbeen had purc... the foot of Fifth Ave. On sions Bas... is intended to build a steam this prope... ting $500,000, where 25,000 power-ho... veloped by means of fuel oil. HP. will ... this power-house have been The plan... contract has not yet been let. adopted. ...

BAIRD ... —William Ellery, of Redding, Cal., has ... application for 124,000 cu. ins. of w... the McCloud River, near this town, for ... purpose of generating electrical power.

LOS A... LES, CAL.—The Los Angeles Ry. Co. ... plates purchasing in the near future ta... 0-KW. motor generators, one 000-KW. ... r generator and nine transformers. ... ward B. Huntington, Los Angeles, is ... Mgr.

OROVI... CAL.—The Oroville Water, Light & ... r Co. contemplates expending about $5... on improvements in Oroville. It is stat... that the company contemplates reducing ... prices of electricity for motors. J. W. Go... in is Pres.

MACKA... IDAHO.—The Lost River Light & Power Co. will erect a lighting plant here. Waters of ... dar Creek will be developed and a 700-ft. pipe-line to a concrete power-house will gener... 150 HP. for the Mackay mines and 50 HP. for lights to the town. R. L. Rockwell, ... Ontario, Ore., is interested.

YUMA, ARIZ.—The contract for furnishing the contr... apparatus for the operation of sluice gates in Laguna Dam, Yuma irrigation project, Cal.-Ariz., has been awarded to the NORTHERN ELECTRICAL MFG. CO., of Madison, Wis., for $4,628.

YARMOUTH, N. S.—The Yarmouth Street Ry. Co., is planning to purchase a 300-KW. generator, turbines and hydraulic equipment. Extensons will be made to the car house. B. G. Burrill is Pres.

PRINCE RUPERT, B. C.—The Provincial Government has approved of the plans of the Prince Rupert Power & Light Co. The company has been authorized to construct a system, including dam, pipe lines and power-house at or near Woodworth Lake, Shoowahtians River, in the Skeena River Mining Division; also to transmit electricity to various points on the Tsimpsean Peninsula and the Digby Islands.

BRANDON, MAN.—George Harper, Ch. Engr. of the International Heating & Lighting Co., Guardian Bldg., Cleveland, Ohio, has a franchise for installing a gas plant here. The work of laying the mains will be started at once. About 15 miles of mains will be laid in all.

MEDICINE HAT, ALTA.—Bids will be received until July 18 for drilling a 6-in. and an 8-in. gas well. W. B. Morrison is City Engr.

BRIDGES.

(* *denotes that this work is advertised in Engineering News.*)

HARTFORD, CONN.—Bids are asked for the repair of the Boulevard bridge across Park River by the Board of Contract and Supply, until 11 a. m., July 6. James P. Berry is Secy. of Bd.

NEW YORK, N. Y.—We are officially advised that the TURNER CONSTRUCTION CO., 11 Broadway, New York, has been awarded the contract for constructing all the reinforced concrete stairs on the Manhattan approach of the Blackwell's Island bridge. The work will be undertaken at once.

ENGLEWOOD, N. J.—Bids are asked until June 25 by the Committee of the Board of Chosen Freeholders, James M. Gulnac, Chn., at Hackensack, for constructing a stone arch bridge on Booth Ave.

*RIVERTON, N. J.—We are officially advised that the following bids were received on June 18 for the construction of a culvert here: B. F. Sweeten & Son, Camden, N. J., 2-ring culvert, $10,666; Calver-Hamburger Co., 704 Arch St., Philadelphia, Pa., single ring, $8,020; Gibbs & Morgan, 12 North Willow St., Trenton, N. J., single ring, $8,000; Harry C. Worrell, Riverton, same, $7,400; A. M. Herkness, Land Title Bldg., Philadelphia, Pa., same, $6,990; Atlantic Construction & Supply Co., same, $6,930; M. Gaudiori, same, $6,703; P. J. Byrne, Burlington, N. J., same, $6,430; Antonio Delucia, 55 Butler St., Trenton, N. J., same, $6,396; New Jersey Contracting & Construction Co., 27 Market St., Camden, $5,520; G. W. Rockwell, Sunbury, Pa., $4,980; Charles N. Smith, 920 Betz Bldg., Philadelphia, Pa., $4,450; HARRY H. WILLIAMS, Burlington, N. J., $4,085 (awarded contract).

BAYONNE, N. J.—The Board of County Freeholders have awarded the contract to JOHN F. MURPHY, of West Hoboken, N. J., for constructing the bridge over the Morris Canal at Ave. C, at $13,280.

HARRISBURG, PA.—NELSON MEREDITH & CO. were awarded the contract on June 17, by the County Commissioners for the construction of a steel bridge over Spring Creek, at $8,335. The contract was awarded on May 22 to Henry and William H. Opperman, at their bid of $7,400. At that time bids were received for the construction of steel, macadam and concrete bridges, but after the successful bidders had requested the court to relieve them of the responsibility of the construction of the bridge, because of several items forgotten in the bid, the County Commissioners decided to advertise this time for bids for the erection of a steel bridge only.

DUNCANNON, PA.—The County Commissioners on June 7 opened bids as follows for constructing a steel bridge over the Lackawanna River here: Penn Bridge Co., of Beaver Falls, Pa., $7,491, and for superstructure only $5,000; York Bridge Co., of York, Pa., $8,100.

MAUCH CHUNK, PA.—HORN & NEFF, of Slatington, Pa., have been awarded the contract by the county at $4,870, for laying a kredone block driveway on the Lehighton bridge.

*PHILADELPHIA, PA.—Contracts for the construction of bridges were awarded on June 15 by George R. Stearns, Dir. Pub. Wks., as follows: On the line of Large St., under the Philadelphia & Frankfort Railroad, 23d Ward, to RICHARD WALSH, 25th and Sedgley Sts., Philadelphia, $26,382, five months; on the line of the Northeast Boulevard, over the Philadelphia & Frankford Railroad, to the McNICHOL PAVING & CONSTRUCTION CO., $33,196, seven months.

MIFFLINTON, PA.—Bids are asked until noon, June 27, by the County Commissioners for the construction of a wooden bridge. J. M. Evans is Clk. Comrs.

HOLLIDAYSBURG, PA.—Bids are asked until 11 a. m., June 29, by the Commissioners of Blair County for the construction of a bridge over Van Scyooc Run in Snyder Township.

PITTSBURG, PA.—We are officially advised that the county has awarded the contract to the JOHN EICHLEAY, JR., CO., South 20th and Wharton Sts., Pittsburg, for the construction of the superstructure of Bridge No. 2 over Lowries Run at $6,122. F. P. Booth is County Controller.

WILLIAMSPORT, MD.—The directors of the Washington & Berkeley Bridge Co., at a meeting held here decided to construct a steel bridge. Mason D. Pratt, Consulting Engr., of Harrisburg, Pa., was instructed to draw the plans and advertise for bids. The bridge will cost between $65,000 and $75,000.

BALTIMORE, MD.—The Owners' Realty Co., Charles W. Hurst, Pres., 1201-1203 Calvert Bldg., Baltimore, will construct a bridge 500 ft. long across Northeast creek to connect Chesaco Park and Rosedale Terraces with Eastern Ave.

EASTON, MD.—The W. W. TUNIS & BRO. LUMBER CO., Tunis Mills, Md., has been awarded the contract at $4,880, for rebuilding Tuckahoe bridge. Bridge is to be wood.

NORFOLK, VA.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of a reinforced concrete bridge over the eastern branch of Newton's Creek, at Lovitt Ave. Bids are asked until June 30.

WALHALLA, S. C.—Bids are asked by Oconee County until July 7 for the construction of an iron bridge over Little River. D. F. McAllister is Superv.

RUSSELLVILLE, ALA.—The ROANOKE BRIDGE CO., Roanoke, Va., has been awarded contracts for constructing two bridges at Taylors Ford and at Mountford, and for a bridge on the county line between Franklin and Marion counties at $6,460 and $6,000 respectively.

NASHVILLE, TENN.—Two bridges will be constructed over the Cumberland River here for the County Court, one at Sparkman St., South Nashville, and one at Jefferson St., North Nashville. The main river spans of both bridges will be composed of two spans 180 ft. and the central spans will be 320 ft. These spans will rest on concrete piers 110 ft. from the foundation, which will be of rock. The main trusses, which will be of steel, will be 52 ft. high at the center, the top being curved towards the ends. Concrete-bow string trusses, will carry the roadway and walks. The main roadway will be 40 ft. in width and the sidewalks 10 ft. J. K. Rains is Chn.

PADUCAH, KY.—The Kentucky & Ohio River Improvement Railroad Co., J. J. Freundlich, Paducah, Gen. Mgr., has awarded the contract to FORBUSH & STOTLAR, Benton, Ill., for the construction of 18 bridges, one to be 1,700 ft. long, on line of railroad to be built between Paducah and Cairo, Ill.

CINCINNATI, OHIO.—Bids are asked until July 3 by the County Commissioners for repairing the bridge over Taylor's Creek at Howler's Crossing by constructing a new abutment. Fred Dreihs is Clk. Bd. Comrs.

VAN WERT, OHIO.—The Plans prepared by J. S. Miller, County Surv., for the construction of a bridge over the canal at Third St. have been approved. The structure will be a steel swing bridge with a driveway and separate walks.

LOGAN, OHIO.—Bids are asked by the Board of County Commissioners until 1 p. m., July 10, for the construction of a concrete arch bridge of two spans, 75 ft. each in length and with an 18-ft. roadway. James Bebout is County Audr.

*JACKSON, OHIO.—We are officially advised that the county has awarded the contract to A. M. TURNER, Greenville, Ohio, for the construction of seven concrete bridges, containing 370 cu. yds. Bids were opened on June 17.

H. H. HOSSMAN, of Portsmouth, Ohio, secured the contract for the construction of one 72-ft. span steel bridge, containing 130 cu. yds. Ed. Monahan is County Audr.

DAYTON, OHIO.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of the Dayton View bridge. Bids are asked until July 18.

ROSEVILLE, OHIO.—Bids were received at the office of the County Commissioners on June 17 for constructing a bridge across Jonathan Creek at the foot of First St. as follows: Champion Bridge Co. (steel), $4,350; Pennsylvania Concrete Co. (not computed); Charles A. Werner, $12,413; E. A. Patterson (not computed); Cook, Grant & Fitz Bros. (not computed); C. W. Hughes, $15,501; Brookville Bridge Co. (steel), $4,300; Schilling Bros. Co., $15,632; Clifton Bros. (not computed); John Werner, $16,143; Dunzweiler Bros., $12,100 to $15,300; R. F. Henry, $12,635; T. M. Townsend, $10,420 and $14,753.

INDIANAPOLIS, IND.—Bids are asked by the Commissioners of Marion County until 10 a. m., July 3, for the construction of bridges in several townships. Albert Sahm is County Audr.

KENTLAND, IND.—Bids are asked by the County Commissioners of Newton County until 1 p. m., July 6, for the construction of a steel bridge, concrete abutments in Colfax Township; a steel bridge, concrete abutments, in Washington Township; for one concrete abutment and repair of another abutment in Township 28; and for 10,000 ft. of oak bridge lumber 2½-in. by 14 to 16 ft. in length. A. E. Purkey is County Audr.

ROCHESTER, IND.—Bids are asked by the Commissioners of Fulton and Marshall Counties until noon, July 8, for the construction of a steel bridge 171-ft. span, 16-ft. roadway, across the Tippecanoe River, and also for two concrete abutments.

SOUTH BEND, IND.—Bids are asked by the Commissioners of St. Joseph County until 11 a. m., July 1, for the construction of two steel beam bridges, one steel pony truss bridge, reconstructing one bridge and one new concrete abutment for the Orphan's Home bridge. John W. Harbon is County Audr.

JASPER, IND.—Bids are asked until July 7 by the Board of County Commissioners for constructing four iron bridges, two in Cass Township and one each in Columbia and Harbison Townships. M. A. Sweeney is County Audr.

BOONVILLE, IND.—The VINCENNES BRIDGE CO., Vincennes, Ind., has been awarded the contract by the county at $41,-009, for constructing eleven steel bridges.

ROCKPORT, IND.—A. P. ELGENMANN has been awarded the contract by the county at $3,432, for constructing concrete bridges.

ANDERSON, IND.—Bids are asked by the Commissioners of Madison County until 11 a. m., July 9, for the construction of several bridges. W. T. Richards is County Audr.

ALBION, MICH.—The city has voted to issue $30,000 of bonds for rebuilding bridges.

OTTAWA, ILL.—A. N. Johnson, State Engr., has submitted estimates to the City Council of the cost of constructing a bridge over the Illinois River, as follows: 20-ft. bridge, local traffic, $65,000; 24-ft. bridge, local traffic, $80,000; 24-ft. bridge, local and interurban traffic, $86,000.

CHICAGO, ILL.—Bids were opened on June 10 at the office of the Sanitary District of Chicago, American Trust Bldg., Chicago, for the fabrication and delivery of all metal work for the superstructures of twelve steel highway bridges across the north shore channel of the Sanitary District of Chicago, in the Village of Wilmette, in the city of Evanston and in the Township of Niles of the city of Chicago. The contract was awarded to the TOLEDO-MASSILLON BRIDGE CO., of Toledo, Ohio, at $59,-990. I. J. Bryan is Clk.

CHICAGO, ILL.—The King Bridge Co., of Cleveland, Ohio, submitted the lowest bid on June 20 to the Department of Public Works for the construction of the superstructure of the bridge over the north branch of the Chicago River at Erie St., at $126,800.

The Fitz Simons & Connell Co., 131 La Salle St., Chicago, submitted the lowest bid for constructing the substructure, at about $70,000. John J. Hanberg is Comr. Pub. Wks.

MANCHESTER, IOWA.—N. M. STARK has been awarded the contract by the county for constructing two reinforced concrete bridges, one a 50-ft. arch and the other a 70-ft. arch.

FARGO, N. DAK.—Bids are asked until noon, July 14, by Arthur G. Lewis, County Audr., for constructing various bridges.

LANDER, WYO.—Bids are asked until 8 p. m., July 14, by William G. Burnett, Town Clk., for constructing a concrete arch over Dickerson Creek at Main St.; also for constructing two concrete culverts over two small creeks on Main St. J. C. Edsall is Town Engr.

HOUSTON, TEX.—Bids are asked until noon, June 30, by John B. Ashe, County Audr., for the construction of a creosote bridge on the Harrisburg and Telephone short cut road.

DURANT, OKLA.—Bids are asked until July 9 by the Commissioners of Bryan County for the construction of a suspension bridge over Island Bayou, near here. J. M. Abbott is Chn. Bd. Comrs.

MALTA, COLO.—We are officially advised that the contract for the construction of a reinforced-concrete bridge near here has been awarded to the PUEBLO BRIDGE CO., Pueblo, Colo., at $3,980. G. N. Houston is Deputy State Engr.

CASTLE ROCK, COLO.—The contract for constructing a two 50-ft. span, reinforced-concrete bridge over Sellers Creek here has been awarded to the PUEBLO BRIDGE CO., of Pueblo, Colo., at $4,423.

SPOKANE, WASH.—Bids for the construction of the viaduct on East Sprague Ave. were received by the Board of Public Works on June 10. Four plans were bid upon, each plan calling for bids for a viaduct sufficient to carry a 36 or a 50-ton car: The bidders were: The American Bridge Co., 42 Broadway, New York, on Plan 4, a dry retaining wall with a rock fill, $78,353 for the lighter and $81,543 for the heavier car, payments to be made by the city in monthly estimates according to material delivered and work performed; the Dana-Boyington Co., $99,-980.60 on Plan 2, calling for a reinforced-concrete viaduct; J. A. Clark, of Spokane, $87,000 on Plan 4, dry retaining walls with dirt or rock fill; the International Contract Co., Seattle, Wash., offered to construct the steel made in monthly estimates satisfactory to the treasurer of the company; on the same plan for 50-ton cars, $94,308; the Northwest Bridge Works, Portland, Ore., $89,-971, on Plan 3, reinforced concrete retaining walls with earth or rock fill, with the provision that $8,800 extra is to be charged in case the street is desired partially open for traffic and payment to be made in monthly installments of 85% of the work done; the Warehouse & Realty Co., Spokane, a steel girder viaduct, supported on tower bents, $85,180, for the lighter car, and $90,180 for the heavier car; the Minneapolis Steel & Machinery Co., Minneapolis, Minn., for the steel viaduct complete $82,815 for the lighter cars and $88,810 for the 50-ton cars; W. H. Bourke, of Spokane, $114,044 for a concrete arch bridge and $122,680 for a steel girder viaduct.

WEISER, IDAHO.—CHARLES G. SHEELEY, 219 McPhee Block, Denver, Colo., has been awarded the contract by the county at $7,189, for the construction of a steel bridge over the Weiser River.

ST. JOSEPH DE BEAUCE, QUE.—Bids are asked by the County of Beauce until June 27 for the construction of an iron and concrete bridge 400 ft. in length over the Chaudiere River here.

BUILDINGS.

(* *denotes that this work is advertised in Engineering News.*)

CALAIS, ME.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded to W. H. FISSELL & CO., St. James Bldg., New York, N. Y., contract for the construction of a post-office at Calais, Me., at $63,900. Time, Nov. 1, 1909.

*PORTLAND, ME.—Bids are asked until 3 p. m., July 30, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (except elevator) of the U. S. court-house at Portland.

PITTSFIELD, MASS.—The Agricultural National Bank has awarded to NORCROSS BROS., 10 East Worcester St., Worcester, the contract for its new building to be erected on the corner of North and Fenn Sts. Work on the structure will be started after July 1 and will be completed early next spring. The contract does not include the vaults or the bank office furnishings. Cost, $150,000. Mowbray & Uffinger, 94 Liberty St., New York, are Archs.

NORTHAMPTON, MASS.—The contract for erecting the library at the Smith College, plans for which have been prepared by Lord & Hewlett, 16 East 23d St., New York, N. Y., will be let soon.

FITCHBURG, MASS.—On July 3 John G. Thompson, Principal of the Fitchburg Public Schools, will choose plans for the proposed 2-story manual training school to be built here, for which $75,000 has been appropriated.

PROVIDENCE, R. I.—Bids are asked until July 1 by William K. Reynolds, Chn. Com. on City Hospital, for erecting several buildings proposed for the City Hospital. Bids are to be on the general construction, plumbing and gas piping, heating and ventilating, electric lighting and other electrical equipment. Martin & Hall are Archs., 806 Union Trust Bldg., Providence. Cost, $100,000.

FORT SLOCUM (New Rochelle post-office), N. Y.—Contracts have been let as follows for the construction of an administration building and a drill-hall and gymnasium at Fort Slocum, N. Y.: GLEN ENGINEERING CONSTRUCTION CO., 156 Fifth Ave., New York, constructing administration building under alternate B, using Indiana limestone, $25,348; constructing drill hall and gymnasium under alternate A, using artificial stone, $40,711; PETER CUNNEEN & CO., New Rochelle, N. Y., plumbing, administration building, $1,200; drill hall, $1,677; WILLIAM S. ROTH, South River, N. J., electric wiring and fixtures in administration building, $841; drill hall, $839.

NEW YORK, N. Y.—We are advised by Mulliken & Moeller, Archs., 103 Park Ave., that estimates will be taken in about two weeks for constructing a 12-story brick and stone store and loft building, 39 × 93 ft., to cost $200,000. The structure will be erected at 149 West 36th St. for Robert S. Finney, 103 Park Ave.

Plans have been filed for enlarging the 9-story loft building at 128 to 132 White St. by adding a 12-story annex, of ornamental brick and stone, with a frontage of 30.3 ft. and a depth of 76 ft. The improvements, which include adding a tenth story to the old building, are to be made for Victor A. Harder, owner, and are to cost $55,000.

Neville & Bagge, Archs., 217 West 125th St., advise us that John W. Kight, 600 West 145th St., is receiving estimates on four 6-story brick and stone apartment houses, 43.9 × 86.11 ft., to cost, altogether, $180,000. The buildings will be erected on the north side of 145th St., west of Lenox Ave.

J. Woodward Haven, 100 East 79th St., will erect a house, costing about $500,000, on the south side of 79th St., 60 ft. west of Madison Ave.

NEW YORK, N. Y.—We are advised by Neville & Bagge, Archs., 217 West 125th St., that they have prepared plans for a 6-story brick and stone apartment building to be erected at Riverside Drive and 144th St. The structure will be 100 × 96.3 and 97.7 ft., and will cost $160,000. Estimates are being taken by the owners, the Gracehill Realty Co., 137th St. and Riverside Drive.

Plans have been filed with the Building Superintendent for a 6-story apartment house to be built for the Braender Building Co., Broadway and Fourth St., at the corner of Broadway and 147th St. It is to have a frontage of 99.11 ft. and a depth of 115 ft. and will be of brick with trimmings of limestone and terra cotta. The design will be of the French Renaissance, finished with balconies at the second and top stories and having an ornamental parapet. It will contain 43 suites of apartments and is to cost $175,000. Clarence True, 726 Sixth Ave., is Arch.

Frederick C. Zobel, Arch., 114 East 28th

St., is preparing plans for a 10-story fireproof office building, which is to be erected at a cost of $300,000 for the Brunswick Realty Co., at 123 East 27th St. through to 118 East 28th St. The building will have an arcade running from street to street, four elevators, and an electric plant.

We are officially advised that P. McMarrow, 362 West 125th St., is taking estimates for a 6-story brick and stone apartment house, to cost $175,000, at the corner of Audubon Ave. and 170th St. Neville & Bagge, 217 West 125th St., are Archs.

*NEW YORK, N. Y.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has rejected, as being in excess of the appropriation, all bids received for the construction of an assay office at New York. The list of bids received on May 12 was given in Engineering News on May 14. The lowest bid was submitted by the P. J. Carlin Construction Co., 16 East 23d St., New York, at $338,250.

We are officially advised that designs for the county penitentiary to be erected on Riker's Island, which the city will erect at a cost of $4,000,000, have been approved by John V. Coggey, Comr. of Dept. of Correction. The designs were made by Trowbridge & Livingston, 424 Fifth Ave., New York.

Schwartz & Gross, Archs., 347 Fifth Ave., advise us that J. B. & J. L. CONNELL, 26th St. and Eleventh Ave., have been awarded contract for the steel work for a 12-story brick and stone apartment house to be built at Riverside Drive and 113th St., by the Akron Building Co., 198 Broadway. Estimates on other work are being taken by the owners. The building will measure 104.4 × 107.6 ft. and will cost $300,000.

We are advised that the contract for building a male dormitory at the New York City Farm, Boro. of Richmond, has been awarded to SAMUEL WEISS, 1826 Washington Ave., New York. Bids were received on June 11 and the award was made on June 12. Robert W. Hebberd is Comr. of Public Charities. R. F. Almirall, 51 Chambers St., is Arch.

NEW YORK, N. Y.—The following bids were received by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, on June 22, for general construction of Public School No. 164, Boro. of Brooklyn: John Kennedy & Co., $280,499; Harry Berry & Co., 101 West 66th St., $277,300; James McArthur, 22 Ormonde Pl., Brooklyn, $279,000; John Kennedy & Son, 103 Park Ave., $285,499; Charles Cranford, Foster Ave., Brooklyn, $292,000; Clarke & Stowe, 221 Greenpoint Ave., Brooklyn, $283,000; George F. Driscoll, 548 Union St., Brooklyn, $288,990; William J. Morgan, Inc., $291,500; John Auer & Son, East New York, $273,899; Richard E. Heningham, 1 Madison Ave., $284,342; William Werner, 892 Forest Ave., $286,810; Patrick Gallagher, 1183 Broadway, $299,509; Patrick Sullivan, 230 Grand St., $286,000; Charles H. Peckworth, 415 Hudson St., $285,443; O'Connell & Hanna, 271 West 125th St., $279,900; Ormond & O'Brien, $288,995; Thos McKeown, 512 West 110th St., $293,333; John F. Reilly, $278,150.

The following bids were received at the same time for installing heating and ventilating apparatus in Public School No. 64, Boro. of Brooklyn: Blake & Williams, 220 West 21st St., $59,984; Frank Dobson Co., Inc., 379 East 53d St., $61,400; Gillis & Geoghegan, 537 West Broadway, $61,449; E. Rutzler & Co., 127 White St., $63,739.

Following are the bids received for alterations and repairs to Public School No. 20, Boro. of Queens: Lawrence J. Rice, 5 East 42d St., $46,607; Hartman & Horgan, $40,-700; Julius Haus, $46,230; William Werner, 892 Forest Ave., $45,888.

The bids received for installing heating and ventilating apparatus in Public School No. 100, Boro. of Manhattan were: Wm. C. Ormond, 909 President St., Brooklyn, $61,-744; James Curran Mfg. Co., 512 West 36th St., $58,000; Frank Dobson Co., 319 East 53d St., $75,200; Blake & Williams, 220 West 20th St., $55,394; E. Rutzler & Co., 127 White St., $58,917; G. A. Suter, $58,400.

NEW YORK, N. Y.—Bids are asked by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, until 11 a. m., July 6, for completing and finishing the heating and ventilating apparatus in Erasmus Hall High School, on the east side of Flatbush Ave., about 205 ft. north of Grand St., Boro. of Brooklyn, in accordance wih the original plans and specifications of contract awarded to Rossman & Bracken Co., which has been declared abandoned; for the construction of pupils' closet building, and improving the sanitary conditions, etc., of Public School No. 12, on the east side of Adelphi St., north of Myrtle Ave., Boro. of Brooklyn; for alterations, repairs, etc., for Public Schools Nos. 17 Annex, 19 Annex, 50 Annex, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 31, 33, 34, 35, 37, 38, 43, 45, 49, 50, 51, 52, 53, 55, 56, 59, 68, 70, 71, 73, 74, 75, 78, 79, 86, 87, 88, 110, 116, 122, 132, 141, 143 and 145, Boro. of Brooklyn; for installing heating apparatus in Public School No. 39, on Sixth Ave. and Eighth St., Boro. of Brooklyn; for new fireproof main stairs at Public Schools Nos. 15, 16, 34, 41, 45 and 56, Boro. of Manhattan; for improving the sanitary condition, etc., of Public Schools Nos. 4, 23, 29, 39, 43, 44, 45 and 52, Boro. of Queens.

The following bids were received by John F. Ahearn, Pres. Boro. of Manhattan, on June 17, for repairs and alterations to City Court House (Brownstone Building), City Hall Park, Chambers St.: George Vassar & Sons, 1170 Broadway, $51,795; A. Feldmann Construction Co., Bible House, $50,220; Charles Meads & Co., 299 Broadway, $47,-700; A. & W. Gray Co., Fuller Bldg., $52,-600; Cantwell Contracting Co., $52,415; Thomas D. Connors, $50,975; N. B. Smyth, 1123 Broadway, $45,439.

The following are the bids received on June 18, by Robert W. Hebberd, Comr. of Public Charities for the excavation, masonry, roofing and metal work, carpentry, electric work, heating work, plumbing work and all other work (except certain kitchen, sterilizing and lighting fixtures and refrigerators), as set forth in the drawings and specifications for the construction and entire completion of a hospital pavilion in connection with the Home for the Aged and Infirm, Blackwells Island, the City of New York: Kelley & Kelly, 45 East 42d St., $48,503; D. J. Ryan, 723 Third Ave., Brooklyn, $44,-880; Thomas J. Waters, 217 West 125th St., $45,400; Thomas B. Leahy, 1 East 42d St., $44,323; Robert Maloney, $47,560.

*ALBANY, N. Y.—The New York State Trustees of Public Buildings received bids on June 22 for the work of constructing an Educational building at Albany, opposite the Capitol, for housing the State Library and the Department of Education. The propositions on which bids were made were: (A) For construction of building with marble and terra-cotta ashlar and exterior facings above the first story level, for exterior walls constituting the Washington Ave., Hawk St. and Swan St. fronts. (B) For construction of building with limestone and terra-cotta ashlar and exterior facings, above the first story level, for exterior walls constituting the Washington Ave., Hawk St. and Swan St. fronts. (BB) For construction of building as above, providing for granite in exterior walls. The bids submitted were as follows: R. T. Ford Co., 206 South Ave., Rochester, N. Y., (A) $2,331,336, (B) $2,-010,000, (BB) $2,200,000; Wells Bros. Co., 160 Fifth Ave., New York, (A) $2,497,000, (B) $2,214,000, (BB) $2,475,000; Charles T. Wills, Inc., 156 Fifth Ave., New York, (A) $2,557,428, (B) $2,242,768 (BB) $2,520,768; Hudson Valley Construction Co., Troy, N. Y., (A) $2,648,444, (B) $2,275,955, (BB) $2,498,-000; Norcross Bros., 10 East Worcester St., Worcester, Mass., (A) $2,710,000, (B) $2,-425,000, (BB) $2,980,000; John Gill Sons, Citizens' Bldg., Cleveland, Ohio, (A) $2,725,000, (B) $2,325,000, (BB) $2,635,000; Hedden Construction Co., 1 Madison Ave., New York, (A) $2,608,347, (B) $2,280,062, (BB) $2,550,-062; George A. Fuller, 949 Broadway, New York, (A) $2,557,900, (B) $2,326,341, (BB) $2,594,675; P. J. Carlin Construction Co., 16 East 23d St., New York, (A) $2,390,000, (B) $2,175,000, (BB) $2,480,000. A bid was also submitted by the Consolidated Engineering & Construction Co., of New York, but was not read, the required deposit not having been inclosed. F. B. Ware is State Arch. Palmer & Hornbostel, of 63 William St., New York, are Archs.

BUFFALO, N. Y.—Charles Mosier, Park Comr., has filed plans for two 12-family apartment houses, three stories high, to cost $85,000.

Bids for erecting the hospital and nurses' home for the Homeopathic Hospital Association will be received about July 15. Probable cost, $125,000. R. D. Kimball, Boston, Mass., is Arch.

The contract for the construction of the U. S. Marine Hospital at Buffalo has been awarded to the DUROLITHIC CO., of 460 Ellicott Sq., Buffalo, N. Y., at $84,354 less for alternate A, rubble foundation, and alternate E, graphite paint, $1,493. Bids were received by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., on May 21. Noted on May 28.

PORT WASHINGTON (L. I.), N. Y.—The following are the bids received June 3 by the board of education for erecting the high school: SMULL & WALSH, of Port Washington, $72,500 (awarded contract); Walters & Woodill, Flushing, $75,500; Fountain & Choate, New York, $76,409; William Young, Co., Brooklyn, $76,600; Robert Bull Co., Flushing, $82,888; Ancell & Kerwin, Freeport, $74,799; Charles Hoffman, Jamaica, $82,385; Andrew J. Robinson & Co., New York, $82,849; Peter Tuthrie, Brooklyn, $76,-273.

YONKERS, N. Y.—C. C. Chipman, 220 Broadway, New York, has let general contract to P. J. FLANNERY, Yonkers, for a 3-story addition to the High School for the Board of Education, Yonkers. Cost, $50,000.

CATSKILL, N. Y.—The Catskill Savings Bank has awarded general contract to the M. L. RYDER BUILDING CO., First National Bank Bldg., Albany, N. Y., for a bank building, on Main St. Cost, $40,000.

DOBBS FERRY, N. Y.—York & Sawyer, Archs., 156 Fifth Ave., New York, have let general contract to S. F. QUICK & SONS, 3 Atherton St., Yonkers, N. Y., for nine asylum buildings, at Dobbs Ferry, for the New York Juvenile Asylum, New York City. Cost, $100,000.

ROME, N. Y.—GRIFFITHS & PIERCE, of Utica, N. Y., have been awarded the contract for the building of a hospital at the County Home in Rome, at $83,550.

NEWARK, N. J.—The H. M. DOREMUS CO., 92 Brunswick St., has secured the contract to erect a 6-story loft building at Clinton and Lawrence Sts., for the estate of S. H. Condit. Cost, $50,000.

*JERSEY CITY, N. J.—Bids were received by the New County Building Committee of the County of Hudson, N. J., at its office, 573 Newark Ave., Jersey City, on June 10, for the interior work of the new court-house, and the power-house building and equipment. Hugh Roberts, 1 Exchange Pl., Jersey City, is Arch.; Alexander J. Clements, Secy. Bldg. Com. We are officially advised that the contract has been let to JOHN GILL & SONS, Citizens' Bldg., Cleveland, Ohio, at $1,250,000.

MONT ALTO, PA.—Bids are asked until 5 p. m., June 29, by Samuel G. Dixon, State Comr. of Health, Harrisburg, Pa., for construction of an infirmary building for the Pennsylvania State South Mountain Sanatorium, near Mont Alto, Franklin County.

EDGEWORTH (Sewickley post-office), PA.—HENRY L. BROWN secured the contract to erect a 3-story residence here for Mrs. N. McKee Graham, to cost $40,000. Charles Barton Keen, 1604 Chestnut St., Philadelphia, is Arch.

ALLENTOWN, PA.—W. J. DOYLE & CO., 1519 Sansom St., Philadelphia, have been awarded contracts for the erection of a ward building and a sewage system, which will complete the State Homeopathic Hospital for the Insane near Allentown. The company's bids were $153,600 for the ward building and $29,518 for the sewage system. The same company was awarded the contract for pipe fitting, the cost of which is yet undetermined. The Commission eliminated Items 2 and 3, which called for a coal pocket and reservoir. The contracts awarded call for the completion of the work in 6½ months. Philip H. Johnson, Land Title Bldg., Philadelphia, is Arch. Noted fully on June 18.

PHILADELPHIA, PA.—A permit has been granted to Charles E. Oelschlager, Arch., 1502 Market St., for a 4-story flat building to be erected at 52d St. and Hazel Ave., for J. Crawford. Cost, $40,000.

WILLIAM R. DOUGHERTY, 1604 Sansom St., has been awarded a contract to build a house for the Delta Chapter of the Delta Psi Fraternity of the University of Pennsylvania at 3635 Locust St. It is estimated that when completed and furnished it will represent an investment close to $100,000. Work will be started at once. Cope & Stewardson, 329 Walnut St., are Archs.

Plans will be prepared by Henry D. Dagit, 435 Chestnut St., for a 3-story parochial school building for St. Edward's Roman Catholic Congregation. Estimated cost, $80,-000.

BALTIMORE, MD.—Theodore W. Pietsch, Arch., American Bldg., advises us that he has prepared plans for an addition to the city jail. Workshops and other improvements will amount to $150,000. Bids will be received by the Board of Award in July and will be advertised for soon.

We are officially advised that the Trustees of the Johns Hopkins Hospital will erect a 5-story concrete office building with brick and stone trimmings. The structure will be 64 × 125 ft. and will cost $100,000. The construction will be done by day work. Baldwin & Pennington, 330 North Charles St., Baltimore, are Archs.

WASHINGTON, D. C.—Bids were received as follows June 18, at the office of the Superintendent of Construction of the new National Museum Building, Washington, D. C., for flooring for the new building: Duke & Smith, Norfolk, Va., Georgia sleepers, per M. lin. ft., $12; flooring, per M. ft. B. M., $32.50. G. Elias & Bro., 965 Elk St, Buffalo, N. Y., Georgia sleepers, $12.50; Georgia flooring, $49,75; maple sleepers, $30; flooring, $45.

BLUEFIELD, W. VA.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded to D. J. PHIPPS, Newport News, Va., contract for the construction of a post-office at Bluefield, W. Va., at $94,786.

WHEELING, W. VA.—Mooney & Mott, Archs., have let general contract to the ELLIOTT WINSLOW CONSTRUCTION CO. for a 3-story and basement fireproof home for the St. John Orphans' Home. Estimated cost, $45,000.

GREENVILLE, N. C.—The contract for erecting four buildings has been awarded to the BUILDING & LUMBER CO., of Greenville, for $81,529. Hooks & Rogers, of Charlotte, N. C., are Archs. T. J. Jarvis is Chn. Com. East Carolina Teachers' Training School. Bids were received June 9.

JACKSONVILLE, FLA.—Bids are asked until July 7 for erecting a 10-story fireproof marble and glazed terra-cotta bank building, 52 × 105 ft., for the Atlantic National Bank, Jacksonville. Mowbray & Uffinger, 92 Liberty St., New York, N. Y., are Archs. Estimated cost, $200,000.

MOBILE, ALA.—The contract to erect the 3-story convent for the Sisters of Mercy has been awarded to W. H. WOOD & CO., of Mobile, at approximately $40,000. A. H. Downey is Arch.

NEW ORLEANS, LA.—Charles Janvier, Chn. of the Real Estate Com., has been directed by the Board of Trustees of Tulane University to ask plans for a gymnasium for the University, the cost not to exceed $40,000.

KNOXVILLE, TENN.—Plans have been completed by Mowbray & Uffinger, Archs., 94 Liberty St., New York, N. Y., for a 1-story bank building for the City National Bank, Knoxville. Cost, $60,000.

LOUISVILLE, KY.—Frank Eckert, proprietor of the Eckert Hotel on Market St., is considering the erection of a hotel, probably on Fifth and Walnut Sts., to cost about $75,-000.

The Columbia Amusement Circuit will erect a theater on Jefferson St. between Third and Fourth Sts. The building will have a seating capacity of 1,800 and will cost $150,-000. John B. McElfatrick & Son, 1402 Broadway, New York, N. Y., are Archs.

CLEVELAND, OHIO.—Plans for a 20-room school to be built here by the Board of Education, have been prepared by F. S. Barnum, Arch., Bd. of Education. Cost, $80,000.

ASHTABULA, OHIO.—Plans have been completed by Briggs & Nelson, Rose Bldg., Cleveland, Ohio, and John Wilson, Ashtabula, Archs., for a 4-story club and gymnasium building for the Y. M. C. A., Ashtabula, to cost $50,000.

LAPORTE, IND.—Bids are asked by Henry Miller, County Audr., Laporte, until July 27, for erecting a jail to cost $75,000. Foltz & Parker, Union Trust Bldg., Indiana, Ind., are Archs.

NEWBERRY, MICH.—Charlton & Kuenzie, Archs., 82 Wisconsin St., Milwaukee, Wis., have let general contract to the FOSTER CONSTRUCTION CO., Milwaukee, for a 3-story high school building for the Board of Education, Newberry, to cost $45,000.

DETROIT, MICH.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded to CONNORS BROS. CO., Lowell, Mass., the contract, at $276,000, for the construction of an extension to and remodeling post-office and court-house at Detroit. Noted on June 11.

The contract for constructing the Gleaners Building has been awarded to JAMES O'SULLIVAN & SON, at about $50,000.

OSHKOSH, WIS.—J. T. [illegible] let mason contract to MEYER & SON [illegible] story addition to the State Normal [illegible] o be built at a cost of $[illegible], which is

RHINELANDER, WIS. [illegible] will be received until 2 p. m., July [illegible] the Building Committee of Oneida [illegible] at Rhinelander for erecting a court [illegible] in Rhinelander. Arthur Taylor is [illegible] H. Tegen, Manitowoc, Wis., is Arch.

SIOUX CITY, IOWA.—[illegible] LE CONSTRUCTION CO., of Sioux [illegible] has secured the contract to remodel the [illegible] Hotel into stores and offices, at a cost of $[illegible].

Plans are being prepared by [illegible] George W. Burkhead, Iowa Bldg., Sioux City, for an auditorium for the Sioux [illegible] for an Association. It is estimated that the building will cost $40,000.

General contract has been awarded by Henry Fisher, Arch., Union Bank [illegible], Sioux City, Iowa, for W. G. Merton, of Emerson, Neb., for building a 6-story bank, office, Loan & Trust Co., James [illegible], Farmers' Press. The building will cost $80,000.

BURLINGTON, IOWA.—[illegible] Goddard, Arch., Tama Block, Burlington, is preparing plans for a 5-story brick [illegible] erected at Fourth and Valley Sts. for S. R. & J. C. McConnell, at a cost of about $100,000.

ST. PAUL, MINN.—J. [illegible] Stevens, Arch., 916 New York Life Bldg., has awarded the contract for a 1-story warehouse for Newton R. [illegible], Germania Life Bldg., to be built on Wabasha St., to W. J. HOLAND CO., Chamber of Commerce Bldg., at a cost of $[illegible].

John H. Wheeler, New York Life Bldg., is preparing plans for a 1-story pressed brick and cut stone dormitory for St. Agatha's Conservatory, Cedar and Exchange Sts. It will have steam heating, electric lighting and plumbing, slate roof, marble and tiled work. There will be a 1-story pressed brick and cut stone refectory and chapel. It will have a seating capacity of 250, steam heating and electric lighting, dinnig room, kitchen, terrazzo floor and refrigerator. Cost, complete, $[illegible].

The First Church of Christ (Scientist) will build a cut-stone church at Summit St., Portland Ave. and Grotto St. This year. Architect will soon be selected. Howard C. Van Meter, St. Paul, is Chn. Bd. of Trustees. Cost, $125,000.

The Home for the Aged, Rev. H. C. Shutt, will build a home at Langford and Snelling Aves. It will be four stories high, of fireproof pressed brick and cut-stone construction.

F. I. Whitney, Chn. Bldg. Com. of the Masons, Endicott Bldg., is taking figures on the construction of the 3-story pressed brick and stone Masonic Temple to be built on Sixth St. and Smith Ave. Cost, $125,000.

Estimates are being taken by J. Walter Stevens, Arch., New York Life Bldg., for a 6-story pressed brick and stone addition for Noyes Bros. & Cutler, druggists, Sixth and Sibley Sts. Cost, $65,000.

FORT MEADE, S. DAK.—The following contracts have been let for the construction complete of commanding officers' quarters, double lieutenants' quarters, eight sets bachelor officers' quarters, band barrack, and administration building at Fort Meade: R. P. & E. O. HAMILTON, Omaha, Neb., all construction, $123,936; SIMONS-POWERS CO., Sioux Falls, S. Dak., all plumbing, $9,411; HEALY PLUMBING & HEATING CO., 277 West Third St., St. Paul, Minn., all heating, $9,242; E. F. NEWBURY & CO., St. Louis, Mo., electric wiring and fixtures, $4,841.

ST. LOUIS, MO.—The Pemberton Investment Co., Zack W. Tinker, Pres., Carleton Bldg., intends to erect a building to cost about $200,000, at Seventh St. and Washington Ave.

Plans are being made by the Vandeventer Trust Co. for the erection of a $50,000 building and the addition of several departments. Work on the building, which will have a frontage of 35 ft. and a depth of 80 ft., will be begun as soon as the plans have been completed and the contract awarded.

Milligan & Wray, Archs., 721 Olive St., have prepared plans for adding two 5-story wings and a 3-story maniac ward building to the insane asylum for the Board of Public Improvements, A. J. O'Reilly, Pres. The additions will cost $600,000 and $75,000, respectively.

FORT WORTH, TEX.—Bids were received as follows June 16 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of a plumbing system in the post-office at Fort Worth, Tex.: Wylie Sanitary Plumbing Co., Jackson, Miss., $5,100, incomplete; Hurley & Co., St. Paul, $7,895; incomplete; Fosdick & Greenway, Fort Worth, Tex., $10,250; Collins Bros., Houston, Tex., $9,417; J. J. Madigan, San Antonio Tex., $9,417; J. J. Madigan, Dallas, Tex., $11,000.

HOUSTON, TEX.—Bids were received as follows June 17 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Houston, Tex.: [illegible] Lumber Co., Charlottesville, Va., $[illegible]; H. L. Stevens, Houston, Tex., $333,000; B. M. Zadeck Co., 135 Adams St., Chicago, $326,000; Wright, Logan & Jackson, Carthage, Mo., $347,500; H. A. Bishop, 218 LaSalle St., Chicago, $328,462; M. P. Wells, Philadelphia, $349,939; M. Yeager & Son, Danville, Ill., $308,490; James A. McGonigle, Leavenworth, Kans., $317,743; Buchanan & Calder, Fort Worth, Tex., $346,738; C. C. Wendel, Houston, Aex., $321,500. Time, Dec. 1, 1909.

SPOKANE, WASH.—Contracts for the erection of seven school buildings and additions to buildings, aggregating $112,251, have been let by the Board of Education, subject to the sale of the recent bond issue of $250,000. These included contract for the erection of four 4-room school buildings at South Manito, Northwest Boulevard, Bisbee Precinct and North Monroe to J. B. SWEATT & CO.,

at a total cost of $52,321. F. E. PETERSON was awarded the contract for an 8-room school section, for $32,074.

SEATTLE, WASH.—M. Donahoe proposes building to cost $250,000 at the corner of [illegible] Ave. and Stewart St.

Beezer, Archs., are preparing plans for a 3-[illegible] office building to be erected by J. M. Co. Co. on Fourth Ave. and Columbia St. [illegible] building will be 60 × 120 ft., of brick [illegible] concrete Class F construction. Plans will be ready by July 1st.

J. A. Colman Bldg., will erect a 7-story [illegible] building at Second Ave. and Pine St. [illegible] plans for this building have been prepared by S. A. Jennings, Arch., 804 Summit Ave., and have been submitted to the Board of Public Works. The building is to be of [illegible] reinforced concrete construction and will cost $[illegible],000.

STOCKTON, CAL.—We are officially advised that the Stockton Investment Co. has secured a permit to erect a hotel to cost $250,000. The structure will be of reinforced concrete construction and fireproof. The contract has been let to VONDER HORST BROS., [illegible] Sutter St., San Francisco, Cal. The building will have five stories, will be 200 × [illegible] ft. and will cost $280,000. The equipment will cost $50,000. E. B. Brown is Arch.

PASADENA, CAL.—H. E. Huntington is having plans prepared for a 2-story concrete house to be erected on the south city limits, at a cost of $75,000.

WHIPPLE BARRACKS (Prescott post-office), ARIZ.—We are officially advised that award of contracts for construction proper, plumbing, heating and electric wiring of hospital at this post, proposals for which were received on May 18, have been made to DURAND B. MOON, Prescott, for construction proper, and GRAEBER BROS., Lawrence, Kan., for plumbing, heating and electric wiring. Capt. Charles C. Walcutt, Jr., is Acting Q. M.

SALT LAKE CITY, UTAH.—William Bowen, 141 East First St. South, Mgr. of the Utah branch of the Crane Co., of Chicago, Ill., has announced that plans are being prepared for a new warehouse to be erected at Second St. and Second West Sts., at a cost of about $100,000.

The Salt Lake Security & Trust Co. will erect an apartment house at Brigham and A Sts. Cost, $400,000. L. D. Martin is Arch. F. E. McGurrin is Pres. of the company.

FORT DOUGLAS, UTAH.—The following awards have been made for the construction of a hospital building at Fort Douglas, Utah: CAMPBELL BUILDING CO., Dooly Block, Salt Lake City, Utah, construction proper, $30,400, additional for items C, F, G, H, I and J, $2,125; McCARTHY & HUNBECK, Salt Lake City, plumbing, $4,150, heating, $4,340; SALT LAKE ELECTRIC SUPPLY CO., 151 South Main St., Salt Lake City, wiring, $702.

PROVO, UTAH.—Bids were received as follows June 23 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Provo, Utah: Campbell Building Co., of Salt Lake City, Utah, $51,377; Tom Lovell & Sons, Denton, Tex., $51,270; George Hinchcliff Co., Chicago, $62,600.

WINNIPEG, MAN.—Bids will be received by the School Board for the erection of two schools, one at Baxter and McIntosh Sts., and another at Pritchard and McKenzie Sts., to cost $80,000 each; also for the Cecil Rhodes School to be erected at E and William Sts., to cost $70,000.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

DOVER, N. H.—Bids for the construction of a filtration plant are asked by the Water Commissioners until June 30. William S. Johnson, 101 Tremont St., Boston, Mass., is Engr.

*MANCHESTER, MASS.—Bids are asked by the Board of Water Commissioners until 8 p. m., July 10, for furnishing and delivering f. o. b. cars, Manchester, or Beverly Farms, Mass., about 443 net tons of 16-in. straight bell and spigot, coated c.-i. pipe Class E, New England Water-Works Association standard, weighing 1,610 lbs. per length of 12 ft.; about 523 net tons of 14-in., weighing 1,310 lbs.; and about 12 tons of special castings. Raymond C. Allen is Engr. Frederick J. Merrill is Chn. Comrs.

MANCHESTER, MASS.—The town has voted to increase its water supply at an estimated cost of $160,000. The work includes about three miles of 14 and 16-in. force-main; a 1,000,000-gallon standpipe; a pumping station of about 2,000,000 gallons capacity, and refitting existing pumping station with larger engines. Raymond C. Allen, Manchester, Mass., is Engr.-in-Charge and F. J. Merrill is Chn. Water Comrs.

PEPPERELL, MASS.—Bids are asked by the Water Commissioners until June 26 for furnishing about 1,700 tons of c.-i. pipe and 30 tons of special castings. William S. Johnson, 101 Tremont St., Boston, Mass., is Engr.

*SPRINGFIELD, MASS.—We are officially advised that the following bids were received on June 18 by the Board of Water Commission for constructing a covered masonry reservoir with gate-houses, dwelling and appurtenances, included under Little River Water Supply Contract No. 3, Proven Mountain reservoir: Ficklen-Baker Construction Co., 1 Madison Ave., New York, $137,855; The Sperry & Sellars Co., New Haven, Conn., $139,850; Coughlin & Sheils Co., 104 Hanover St., Boston, Mass., $144,955; Coleman Bros., Boston, Mass., $147,400; the New York Continental Jewell Filtration Co., 15 Broad St., New York, $147,825; James E. Bunting, Robert Bull & Co., Inc., Flushing, L. I., N. Y., $148,990; Falvey & Kelly, Salem, Mass., $151,750; Manufacturers' Contracting Co., Wilmington, Del., $154,595; T. Stewart & Son Co., Newton, Mass., $156,850; Loring N. Farnum Co., 405 Exchange Bldg., Boston, Mass., $162,105; Bruno & Petitti, Boston, Mass., $168,700; Fred T. Ley & Co., Springfield, Mass., $174,340; W. W. Lindsay & Co., Harrison Bldg., Philadelphia, Pa., $174,810; Long & Little Co., Leominster, Mass., $179,625; Merrill-Ruckgaber-Fraser Co., 50 Church St., New York, $187,465; Leahy Contracting & Construction Co., 1446 Prospect Ave., New York, $219,725. E. E. Lochridge is Ch. Engr. Itemized bids in detail will be given next week under Contract Prices. Contract has been let to the FICKLEN-BAKER CO.

*CONCORD, MASS.—Bids are asked by Metcalf & Eddy, Engrs. for the Water and Sewer Commissioners, 14 Beacon St., Boston, Mass., until 10 a. m., July 8, for laying c.-i. pipe and appurtenances and constructing a reservoir here.

BALTIC, CONN.—The Baltic Mills, Baltic, have awarded to the AMBURSEN HYDRAULIC CONSTRUCTION CO., 176 Federal St., Boston, Mass., the contract for the construction of two reservoir dams, 18 × 300 and 30 × 180 ft., respectively. Both dams are on gravel foundations. Chandler & Palmer, of Norwich, Conn., are the Consulting Engrs. for the owners.

*ALDEN, N. Y.—Bids are asked until noon, July 1, by S. M. Stowell, Secy. Water Bd., for excavating the water mains here.

BUFFALO, N. Y.—Bids were opened on June 13 by Francis G. Ward, Comr. Pub. Wks., for c.-i. pipe and special castings and for hydrants. The lowest bids were submitted by the U. S. Cast-Iron Pipe & Fdry. Co., 71 Broadway, New York, for c.-i. pipe at $23.50 per ton and 2½ cts. to 3 cts. per lb. for castings, and the Howard Iron Works for hydrants.

FORT HAMILTON (Brooklyn post-office), N. Y.—Bids for the construction of a water and sewer system extension at Fort Hamilton were received by the Constructing Quartermaster on June 15, as follows: McKay Engineering Co., 9 East Lexington St., Baltimore, Md., $5,969; Russell Constructing Co., 156 5th Ave., New York, $6,500; Nicholas Heating & Plumbing Co., 40 West State St., Columbus, Ohio, $4,500; Murphy Bros., 25th and Cropsey Aves., Brooklyn, N. Y., $4,760; Marcus S. Wright, South River, N. J., $7,804; the Donegan & Redmond Co., 5904 14th Ave., Brooklyn, $4,755; Atlantic Construction & Supply Co., Bartlett Bldg., Atlantic City, N. J., $4,755.

OSWEGO, N. Y.—Plans have been completed for the construction of a pump house to be built on the lake shore in connection with the lake water plant. Bids will soon be asked. Estimated cost, $12,000.

CAMDEN, N. J.—Bids were opened on June 22 by the Water Commission for increasing the city's water supply. The bidders were: T. A. Gillespie Co., 90 West St., New York, to construct a plant and dispose of it at any time to the city at $750,000, and $300 per day to furnish the city with an additional supply of water; M. P. Quinn, of Philadelphia, Pa., $550,000 and $195.

*MONT ALTO, PA.—We are officially advised that the following bids were received on June 9 by the State Health Department, Harrisburg, for the construction of a water-works system for the Pennsylvania State South Mountain Sanatorium: W. L. Forney, Chambersburg, Pa., $32,041; Charles W. Denny, 1330 Arch St., Philadelphia, Pa., $64,534; W. G. FRITZ, York, Pa., $25,167 (awarded contract); the Ahrens Construction Co., Lewistown, Pa., $27,325; Brady & Snaveley, Harrisburg, Pa., $26,486; F. A. Havens & Co., Perry Bldg., Philadelphia, Pa., $40,593; the Pitt Construction Co., Fulton Bldg., Pittsburg, Pa., $31,535; McCay Engineering Co., 9 East Lexington St., Baltimore, Md., $36,901; McCormick & Co., 14 South Broad St., Philadelphia, $21,176. The Engineer's estimate was $27,725.

TARENTUM, PA.—The citizens on June 16 voted in favor of issuing $100,000 of bonds for the construction of a municipal water plant.

BRADFORD, PA.—Bids will soon be asked by the Tidewater Pipe Line Co. for the construction of a 550-mile line from Bradford to Robinson, Ill. Estimated cost between $2,000,000 and $3,000,000.

BALTIMORE, MD.—We are officially advised that the following bids were received on June 10 by the Board of Awards for the construction of a 225,000,000-gallon reservoir and diversion sewer in connection therewith for the Baltimore City Water Department: (a) reservoir, (b) sewer, (c) totals. LANE BROS. CO. & JONES, 811 Fidelity Bldg., Baltimore, (a) $494,810 (awarded contract), (b) $44,524, (c) $539,334; Fisher-Riley & Carozza, Baltimore, (a) $530,470; C. B. CLARK & CO., 10 East Lexington St., Baltimore, (b) $33,572 (awarded contract); Evre-Shoemaker, Inc., Arcade Bldg., Philadelphia, (a) $589,414, (b) $49,129, (c) $638,544; David Peoples, Betz Bldg., Philadelphia, (a) $590,376, (b) $48,165, (c) $638,541; Fidelity Construction Co., Detroit, Mich., (a) $650,825; Reilly & Riddle, Lancaster, Pa., (b) $40,461; Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., (a) $654,109, (b) $45,081, (c) $699,190; Robert C. Storrie, Fort Worth, Tex., (a) $663,236, (b) $49,177, (c) $712,413; Cranford Paving Co., Washington, D. C., (a) $780,450, (b) $54,104, (c) $814,554; William B. Munroe, Boston, Mass., (a) $74,680, (b) $60,130, (c) $834,810; United Engineering & Contracting Co., 32 East 33d St., New York, (a) $837,241, (b) $73,563, (c) $910,804; Albert Weber, Baltimore, $40,923; Falvey & Kelly, Boston, Mass., $50,243; Metropolitan Contracting Co., Baltimore, $73,986. Itemized bids will be given next week under Contract Prices.

RUSSELLVILLE, ALA.—Bids will soon be asked by the town for furnishing materials, equipment and construction of a combined water and light plant. Edgar B. Kay, Tuscaloosa, Ala., is Engr.

*STURGEON BAY, WIS.—See under Light and Power Plants.

SWEETWATER, TENN.—GUILD & CO., of Chattanooga, Tenn., have been awarded the contract for constructing the water-works system here.

SHAWNEE, OHIO.—The citizens on June 16 voted in favor of issuing $25,000 of bonds for the construction of a water-works system.

NEWTON FALLS, OHIO.—Bids are asked until July 2 by the Board of Public Service for c.-i. pipe, special castings, excavation and laying of pipes, approximately 250 tons of 4, 6 and 8-in. c.-i. pipe, three tons of special castings, 30 fire plugs and 20,000 lin. ft. of excavation.

KNOX, IND.—George C. Morgan, 169 Jackson Boulevard, Chicago, Ill., is preparing plans for the construction of water-works. Estimated cost, $15,000. The town will do the work. H. C. Wise is City Clk.

HAMMOND, IND.—Bids are asked until 10 a. m., June 29, by the Board of Public Works for furnishing and laying ¾-in. lead water service pipe connections in Morton Ave., from Calumet Ave. to Columbia Ave.

BERWYN, ILL.—Bids are asked by William S. Dolbey, City Clk., until 8 p. m., June 30, for the construction of a steel reinforced-concrete reservoir with a capacity of 100,000 gallons. Plans may be examined at the offices of the City Clerk and of H. L. Emerson, Engr., 1206 Chamber of Commerce Bldg., Chicago, Ill.

CHICAGO, ILL.—Bids are asked by the Board of Local Improvements until 10.30 a. m., June 26, for constructing water service pipes in various streets. Charles A. V. Standish is Secy. Bd.

RHINELANDER, WIS.—Bids are asked until 2 p. m., June 29, by the Board of Public Works for furnishing materials and laying a 6-in. water main. Gust Swedberg is Secy. Bd.

RICKETTS, IOWA.—Bids are asked until July 6 by the City Council for constructing a water-works system. J. C. Jacobsen is Mayor.

CARRINGTON, MINN.—Bids are asked by the City Council until 8 p. m., July 6, for laying water-mains. H. L. Winterer is City Audr.

NORFOLK, NEB.—Bids are asked until noon, June 30, by the City Council for constructing a water-main in several streets. J. D. Sturgeon is Mayor.

VELVA, N. DAK.—Oscar Claussen, Consulting Engr., St. Paul, Minn., has awarded the contract for the construction of the water-works system here to C. H. PORRITT, Fargo, N. Dak., at $25,000. J. E. Henkle is City Audr.

*MINOT, N. DAK.—Bids are asked until 8 p. m., July 13, by the City Auditor, for the purchase of $32,000 of 6% 20-yr. water-works bonds. G. L. Morrow is City Audr.

WAHPETON, N. DAK.—The following bids were opened on June 16 by the Commissioner of Indian Affairs, Washington, D. C., for constructing a water system at the Wahpeton Indian School: J. J. Richter, Wahpeton, $8,696; time, Nov. 1, 1908; Des Moines Bridge & Iron Co., Des Moines, Iowa, $8,188; time, Nov. 1, 1908; W. D. Lovell, Minneapolis, Minn., $8,400; time, six months; Frank A. Hanmock, Morris, Minn., $8,978.

TOWNER, N. DAK.—Lykken & Robinson, of Grand Forks, N. Dak., have completed plans for the construction of the water-works system, to consist of one mile of mains, 100-ft. steel tower with 60,000-gallon tank and a gasoline pumping engine. Bids are asked until June 30 by the City Council. Estimated cost, $15,000.

WYNCOTE, WYO.—The contract has been awarded to the COLORADO GRAY IRON FOUNDRY CO., of Denver, Colo., for furnishing cast-iron gates, lifting devices, etc., for use in connection with the Interstate canal, North Platte irrigation project, Nebraska-Wyoming, at $3,498.

TEMPLE, TEX.—The city will expend $30,000 in improving and extending the water-works plant recently purchased at a cost of $120,000. P. Bracken is Supt.; N. Nirrushoid, Dallas, Tex., is Archt; C. N. Campbell is Chn. Water Comn.

DALLAS, TEX.—The HUGHES O'ROURKE CO. has been awarded the contract at $27,777 for the construction of the pumping station, including an engine room 100 × 60 ft., boiler room 40 × 70 ft.; pumping engine to have a capacity of 10,000,000 gallons.

SALLISAW, OKLA.—The citizens have voted in favor of issuing bonds for the construction of water-works.

HOLLY, COLO.—The town has voted to issue $10,000 bonds for the construction of water-works. N. F. Vidal is Town Clk.

PORTLAND, ORE.—The City Water Board has awarded to CALDWELL BROS., of Seattle, Wash., contract for water valves at $3,410.

YUMA, ARIZ.—The NORTHERN ELECTRICAL MFG. CO., of Madison, Wis., has been awarded the contract for furnishing controlling apparatus for the operation of sluice gates in the Laguna dam, Yuma irrigation project, California-Arizona, at $4,629.

*KIMBERLEY, NEV.—We are officially advised that the following contracts were awarded on June 18 by the Giroux Consolidated Mines Co., 42 Broadway, New York, for the installation of a water supply system here: For two Class "A" No. 14 Stirling boilers to the BABCOCK & WILCOX CO., 85 Liberty Co., New York, at $8,565; one crank and fly-wheel high-duty pumping engine, 500,000 gallons capacity, one triple-expansion pumping engine, 500,000 gallons capacity, to the EPPING-CARPENTER CO., 41st St., Pittsburg, Pa., at $10,500 and $7,500, respectively; 25,000 ft. of 8-in. steel pipe ⅜ in. thick, to the NATIONAL TUBE CO., 30 Church St., New York, at $1,4085 per ft.; 6,000 ft. of No. 12, 26,000 ft. of No. 14, 13,000 ft. of No. 16 spiral riveted 8-in. pipe, to the AMERICAN SPIRAL PIPE CO., 50 Church St., New York, at 86, 66 and 56½ cts., per ft.; for the construction of the pipe line and reservoir, to the AMERICAN LIGHT & WATER CO., Los Angeles, Cal., at $40,451. Alexander Potter, C. E., is Engr.-in-Charge, 143 Liberty St., New York.

CALGARY, ALTA.—Extensive improvements are planned by the city for the water supply system. A pipe line and reservoir will be constructed, the pipe line to be 10½ miles long and 30 ins. in internal diameter, reducing to 24 ins. at the outlet. The intake is at an elevation of 300 ft. above the general city level, and a reservoir to contain about 25,000,000 gallons will be constructed slightly below the outlet. The water level is now at an elevation of 220 ft. above the city. The reservoir is located just on the outskirts of the city, every portion of which can be supplied under good pressure.

SEWERAGE.

YARMOUTHVILLE, ME.—FALES & SIMMONS have been awarded the contract for constructing 2,100 ft. of sewer on Main and Center Sts.

LITCHFIELD, CONN.—The contract for the construction of 13,000 lin. ft. of sewer in the borough has been awarded to the PIERSON ENGINEERING & CONSTRUCTION CO., Bristol, Conn., at $16,119. The contract calls for 2,200 ft. of iron pipe, the balance tile pipe; also 100 house connections, manholes, catch basins, etc.

EAST HARTFORD, CONN.—The Board of Sewer Commissioners on June 18 awarded the contract for the construction of 2,400 ft. of 8-in. and 800 ft. of 10-in. pipe sewer in Burnside Ave. and Larrabee and Belden Sts. to A. E. DOUGLASS of Glastonbury, Conn. Edward E. King is Pres. Bd. C. H. Olmsted is Engr.

THOMPSONVILLE, CONN.—Bids are asked by the Board of Sewer Commissioners until noon, July 7, for the construction of 3,600 lin. ft. of sewer with two flush tanks and ten manholes, to be of first-class Akron or Ohio River pipe. Plans and specifications may be examined at the office of the Secretary of the Board.

*MERCHANTVILLE, N. J.—The Council on June 17 awarded the contract for the completion of the sewerage system and a disposal plant to B. T. SWEETEN & CO., of Camden, N. J., at $37,000. A. W. MacCallum is Chn. Council.

PLAINFIELD, N. J.—Plans and specifications for the construction of sewers, house connections and appurtenances are on file at the office of Engineering News, New York. Bids are asked until July 6.

ERIE, PA.—Bids are asked by the Chairman of the Joint Session of Councils until 8 p. m, June 25, for the construction of two 15-in sewers. B. F. Briggs is City Engr.

MONACA, PA.—J. L. CONNOR, of Freedom, Pa., was awarded the contract on June 15 by the Council for the construction of sewers in portions of Fifth and Sixth Sts., Pennsylvania Ave., Indiana Ave., at $3,010.

WILLIAMSPORT, PA.—Bids are asked until June 30, by J. J. Galbraith, City Clk., for constructing three sewers.

BENTLEYVILLE, PA.—Bids are asked until July 6, by C. C. Hanlon, Borough Engr., for constructing two sewers.

ALLENTOWN, PA.—See under Buildings.

WASHINGTON, D. C.—Bids were received as follows on June 22 at the office of the Commissioners of the District of Columbia for the construction of a sewer in Delafield St., near Iowa Ave.: (a) R. J. Beall Construction Co., Washington; (b) E. G. Gummel, 300 Rhode Island Ave., Washington; (c) James A. Coyle, Washington. Ordinary excavation, (a) 65 cts., (b) 90 cts., (c) 80 cts.; brick masonry, (a) $15, (b) $15, (c) $16; 12-in. sewer pipe, 70 cts. (each bidder); 10-in. sewer pipe, (a) 65 cts., (b) 70 cts., (c) 65 cts.

WASHINGTON, D. C.—The Commissioners of the District of Columbia made the following awards for sewers in the District: WARREN J. BRENIZER CO., Second and O Sts., S. E., Washington, Beach Drive, between Piney Branch and Pierce Mill Road, $7,347; Blagden Ave., Beach Drive to Decatur St., $6,120; Blagden Ave. and 16th St. between Hamilton and Decatur Sts., $3,590. R. J. BEALL CONSTRUCTION CO., 1225 F St., N. W., Washington, Arizona Ave. northwest of canal road, $4,136. E. G. GUMMEL, 300 Rhode Island Ave., Washington, 2d St., N. E., between F and G Sts., $4,626. JAMES A. COYLE, Washington, Massachusetts Ave., between Observatory Circle and Wisconsin Ave., $4,467.

Bids were received as follows on June 19 at the office of the Commissioners of the District of Columbia for furnishing sewer brick for the ensuing fiscal year: New Washington Brick Co., Washington, $8.63 per M., at bidder's works, Alexandria County, Va.; John Miller, Washington, D. C., $8.50 at District property yard, $7.95 at works, Alexandria County; 50 cts. less per M. for cheaper quality; Frederick Brick Works, Frederick, Md., $8.50 at District property yard; $7 at works, Frederick.

PORTSMOUTH, VA.—Bids are asked by the Sewerage Committee at the office of the City Clerk until 8 p. m., July 28, for the construction of a sanitary sewer system for the Fifth Ward. Bascom Sykes is City Engr.

WHEELING, W. VA.—The WHEELING WALL PLASTER CO., Wheeling, has been awarded the contract for furnishing the city with sewer pipe during the coming year.

MOBILE, ALA.—Bids are asked until noon, July 13, by the Board of Public Works for the construction of storm sewers. Wright Smith is Ch. Engr. Bd.

KNOXVILLE, TENN.—We are officially advised that the Board of Public Works on June 18 awarded the contract for the construction of the extension to the First Creek sewer main, about 7,000 ft. long, using 18, 15 and 12-in. vitrified pipe, except in some few points where it was found necessary to use c.-i. pipe, to JOHN L. O'CONNOR, at $11,820. S. D. Newton is City Engr.

*LOUISVILLE, KY.—Bids are asked until noon, July 17, by the Commissioners of Sewerage for the construction of Section "B" of the comprehensive system of Sew-

erage. Plans and specifications may be examined at the office of the Commissioners and at the office of Harrison P. Eddy, Consulting Engr., 14 Beacon St., Boston, Mass. P. L. Atherton is Chn. Bd. J. B. F. Breed is Ch. Engr.

*WADSWORTH, OHIO.—Bids are asked until noon, July 6, by Louis F. Allen, Village Clk., for the construction of a sewerage disposal plant.

CLEVELAND HEIGHTS (Cleveland post-office), OHIO.—Bids are asked until noon, July 7, by William G. Phare, Village Clk., 204 American Trust Bldg., Cleveland, for constructing a sewer in parts of Compton and Highland roads. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, are Engrs.

CORLETT (Sorrento post-office), OHIO.—Bids are asked until noon, July 6, by W. H. Jantzen, Village Clk., for the construction of sewers in several streets. The Courtney Engineering Co. are Village Engrs., 407 American Trust Bldg., Cleveland, Ohio.

TOLEDO, OHIO.—Bids are asked until July 1, by the Board of Public Service for constructing local sewers Nos. 1038 and 1040 in districts Nos. 23 and 28, respectively. Reynold Voit is Secy. Bd.

CLEVELAND, OHIO.—Bids are asked until noon, June 30, by the Board of Public Service for the construction of sewers in certain streets and avenues. A. R. Callow is Secy. Bd.

ST. BERNARD (Cincinnati post-office), OHIO.—Bids are asked until noon, July 2, by George Schroeder, Village Clk., for the construction of a sewer in Carthage pike.

SPRINGFIELD, OHIO.—Bids are asked until noon, July 3, by the Board of Public Service for the construction of sanitary and connecting sewers in various streets and avenues. William H. Mahoney is Clk. Bd.

STEUBENVILLE, OHIO.—Bids are asked until noon, June 29, by the Board of Public Service for the construction of a 20-in. vitrified pipe sewer in Slack St. H. G. Simpson is Clk Bd.

LAKEWOOD, OHIO.—Bids are asked until 11 a. m., June 29, by B. M. Cook, Village Clk., for the construction of several sewers.

GAS CITY, IND.—The contract for the construction of a sewer here was awarded on June 16 by the Council to the GAS CITY CONSTRUCTION CO., at $15,261.52, which is slightly less than the estimated cost.

HAMMOND, IND.—Bids are asked by the Board of Public Works until 10 a. m., June 29, for the construction of an 18-in. double-strength vitrified sewer in Indiana Ave.

WABASH, IND.—Bids are asked by Fremont M'Lees, City Clk., until 6 p. m., July 13, for the construction of a combined storm-water, main and local sanitary sewer in Water St.

IRON RIVER, MICH.—Bids are asked until June 29 by the Board of Village Trustees for constructing a sewerage system. James B. Henley is Village Clk.

MERRILL, WIS.—Bids are asked by the Board of Public Works until June 29 for constructing a sewer in a portion of State St. William J. Keyes is City Clk.

VIRGINIA, MINN.—Bids are asked by Albert E. Bickford, City Clk., until June 30, for constructing a sanitary sewer in sewer district No. 1. E. F. Johnson is City Engr.

PRATT, KAN.—Bids are asked until noon, July 24, by the City Clerk for the construction of a sewerage system.

DAVID CITY, NEB.—Bids are asked until July 8, by W. S. McCoy, City Clk., for the construction of a sewerage system. M. A. Earl & Co. are Engrs., First National Bank Bldg., Chicago, Ill.

DILLON, MONT.—Bids are asked until 8 p. m., July 1, by J. B. Poindexter, City Clk., for constructing 7,400 ft. of sewer. George R. Metlen is City Engr.

JEFFERSON CITY, MO.—Bids are asked by the Council until 4 p. m., June 29, by the City Clerk for the construction of sewers in subdivision "B" of sewer district No. 7. E. F. C. Harding is City Engr.

ST. LOUIS, MO.—All bids were rejected on June 19 by the Board of Public Improvements for keeping all public sewers in repair for one year, including furnishing all necessary material. The bids follow: McIntire-Teese Construction Co., $39,710; Richard J. Shea & Co., $45,068; The Prendergast Contracting Co., $39,649; Hoffmann-Hogan Construction Co., $36,417; William F. Riley Construction Co., $39,312; Cooney Construction Co., $43,540; Clarke & Ansbro, $50,311; Hoosac Building & Construction Co., $56,887; Geisel Construction Co., $47,726.

HOUSTON, TEX.—The following bids were received on June 15 by the City Council for the construction of a sewer lift in the South End: Collins Bros., mechanical equipment alone, $4,000; Young & McCoy, excavations and walls alone, $3,817; Lighthouse & Sargent, excavations and walls, $5,078; Webber-Duller Construction Co., plant complete, $8,000; L. H. Coley, plant complete, $7,478; same, plant complete, (smaller air compressor), $7,270; F. D. Horton, excavation and walls, $4,725; same, mechanical equipment, $3,231. L. H. Coley also offered to do the work at a 10% advance over the actual cost of material and labor.

ALBUQUERQUE, N. MEX.—Bids are asked until 10 a. m., June 27, by the County Commissioners for laying a sewer line along the road from the county jail. A. E. Walker is Clk. Comrs.

PORT TOWNSEND, WASH.—Bids will soon be asked by the city for the construction of another sewer district. Plans and specifications are now ready waiting for approval by the Mayor and Council.

SPOKANE, WASH.—The following bids have been received by the city for the construction of a trunk sewer in the First Ward, district No 3: Foster & Hindle, $75,876; Lang & Smith, $72,300; John Fife, $74,844; Julia V. Costello, $75,590; JAMES C. BROAD, $67,965 (awarded contract); Independent Asphalt Paving Co., $71,500. Engineer's estimate, $81,592.

SAN FRANCISCO, CAL.—The Board of Public Works on June 15 awarded the contract to the HEALY-TIBBITTS CONSTRUCTION CO., 268 Market St., San Francisco, for constructing a reinforced-concrete sewer in Commercial St., between Drumm and Sansome Sts., at about $26,779, and in California and Sacramento Sts., between Drumm and Davis Sts., at $9,958. Marsden Manson is City Engr.

O. I. McHUGH has been awarded the contract at $11,649 for the construction of a sewer in Fulton St., between 37th and 47th Sts.

MONTREAL, QUE.—The Roads Committee on June 12 awarded the following contracts for the construction of sewers: To L. GIGUERE, sewer in Belanger St., $14,622; M. DINEEN, sewer in Christopher Columbus St., $17,382; MEREDITH & HEFFERNAN, sewer in Dufferin St., $16,898; J. GIGUERE, sewer in Demontigny St., $53,407; fourth section of relieving sewer to Back River the REXFORD BESHOP CO., $54,573.

WELLAND, ONT.—JOHN CONNOLLY, Toronto, Ont., has been awarded the contract by the city for the construction of sewers in the North Ward at about $15,000.

GARBAGE DISPOSAL.

RANKIN, PA.—Bids are asked until 2 p. m., July 2, by C. Koellman, Boro. Secy., for the construction of a 10-ton garbage crematory.

MONT ALTO, PA.—Bids are asked by the State Health Commissioner until June 30 for the construction of a garbage and refuse disposal plant at the State Sanitorium here.

SHELBURNE, ONT.—Bids are asked until June 29 by the town for furnishing a rock crusher. W. A. Hillhouse is Town Clk.

STREETS AND ROADS.

BIDDEFORD, ME.—The Committee on Streets awarded the contract on June 15 to the NORTHEASTERN PAVING & CONSTRUCTION CO. for paving Elm St., from Cutts to Mason Sts., at $1.75 per sq. yd.

CONCORD, N. H.—Bids are asked until June 30 by A. W. Dean, State Engr., Highway Dept., Concord, for grading and surfacing with gravel a portion of the Gorham and Randolph road in the town of Gorham, and the Notch road in the town of Errol.

*LAWRENCE, MASS.—Bids are asked until 3 p. m., July 8, by A. D. Marble, City Engr., for about 28,000 sq. yds. of street paving with wooden blocks in concrete base.

BRIDGEPORT, CONN.—We are officially advised that the following contracts have been awarded for paving materials: For furnishing about 4,975 sq. yds. of brick, about 43 to the yard, to the MACK MFG. CO., Land Title Bldg., Philadelphia, Pa., at $31.26 per M. f. o. b. Bridgeport, 5-yr. guarantee; for furnishing about 885 sq. yds. of wood block paving f. o. b. Bridgeport, 5-yr. guarantee, about 54 to the sq. yd., to U. S. WOOD PRESERVING CO., 29 Broadway, New York, at $37.04 per M.; for furnishing about 930 bbls. of Portland cement in (a) paper per barrel 380 lbs., (b) cloth, to the SILLIMAN & GODFREY CO., Bridgeport, Conn., at (a) $1.25 per bbl., (b) $1.55; for furnishing about 1,400 tons, net, of crushed stone (granite) f. o. b. Bridgeport, to same, at 90 cts. per ton, net. M. F. McKenna is City Engr.

MIDDLETOWN, CONN.—The contract for the construction of 5,850 lin. ft. of telford road in this town has been awarded to L. SUZIO, of Meriden, Conn., at $8,516. Other bidders were: O. T. Benedict, Pittsfield, Mass., $14,960; Roger Kennedy, Middletown, $17,542; Donahue Bros., Middletown, $12,880; A. Brazos & Sons, Middletown, $18,490.

HARTFORD, CONN.—Contracts for state road construction were awarded on June 15 by the State Highway Commissioner, as follows: Town of Plainville, 2,509 lin. ft. of telford on Whiting St., JOSEPH MASCETTI, Torrington, Conn., at $1.95 per lin. ft. for 20-ft. width and 45 cts. per lin. ft. for 9-ft. width. Other bidders were: Pierson Engineering & Construction Co., Bristol, Conn., $2.65 and 55 cts.; B. D. Pierce, Jr., Co., Bridgeport, Conn., $1.33 and 79 cts. Town of Cromwell, 5,075 lin. ft. of telford on the Berlin pike, including two 12-in. tile culverts, McDONALD & HENNESSEY, Middletown, $5,786. Other bidders were: O. T. Benedict, Pittsfield, Mass., $7,054.25; B. D. Pierce, Jr., Co., $6,039; A. Brazos & Sons, $5,725. Town of Waterbury, 3,365 lin. ft. of macadam on Naugatuck road. O. T. BENEDICT, Pittsfield, Mass., $6,023. Other bidders were: Edward McManus, Waterbury, $7,723; Joseph Mascetti, $6,393. Two 18-in. tile culverts called for in specifications; Town of Haddam, 7,550 lin. ft. of grading and retaining wall, including two 24-in. and five 12-in. tile culverts, ROGER KENNEDY, Middletown, $5,285, and $4.65 per cu. yd. for wall. Other bidders were: O. T. Benedict, $8,737 and $3; F. Arrigoni & Bro., $5,350 and $4.60; A. Brazos & Sons, $5,690 and $4; B. D. Pierce, Jr., Co., $7,021.50 and $6.50.

STRATFORD, CONN.—The following bids were opened on June 10 for the construction of 2,800 lin. ft. of macadam on Main St.: B. N. Beard, Shelton, Conn., $3.50 per lin. ft., 90 cts. for Belgian block and 45 cts. for cobble gutters; C. T. Benedict, Pittsfield, Mass., $3.75, 50 cts. and 70 cts.; B. D. Pierce, Jr., Co., Bridgeport, 79 cts. per sq. yd.; E. N. Clarke, Milford, Conn., $3.69 and 36 cts.

HARTFORD, CONN.—Bids are asked at the office of the State Highway Commissioner, Capitol, until noon, June 27, for the following road work: Town of East Haddam, 1,900 lin. ft. of macadam construction on Moodus road; town of Norfolk, 1,375 lin. ft. of grading construction on Colebrook road, one 24-in. tile culvert; town of Colchester, 3,050 lin. ft. of gravel construction on Broadway, two 18-in. and one 24-in. tile culverts; town of Colebrook, 2,750 lin. ft. of grading on main highway to Winsted, one 12-in. tile culvert; town of Putnam, 3,285 lin. ft. of gravel-telford construction on Providence road, one 12-in. tile culvert; town of Old Lyme, two sections highway, 7,250 lin. ft. gravel and 380 lin. ft. of macadam, two 12-in., two 15-in. and two 20-in. tile culverts.

NEW YORK, N. Y.—We are officially advised that the ABBOT-GAMBLE CO., 32 Broadway, New York, have been awarded the contract for the construction of the sidewalks on the Blackwell's Island bridge.

ROCHESTER, N. Y.—The contract for paving Hawley St. with brick has been awarded by the Board of Contract and Supply to F. C. LAUER & SONS, at $24,162.

WHITMORE, RAUBER & VICINUS have been awarded the contract for laying asphalt pavement on Huntington St. at $6,064.

ALBANY, N. Y.—The following bids were received by the Board of Contract and Supply on June 15 for the improvement of Plum St., from Dallius St. to Franklin St.: Mulderry Bros., $7,513; Michael F. Dollard, $6,995; Edward F. Dillon, $7,601; John M. Holler, $7,378. Walter Mellus is City Engr.

NEW YORK, N. Y.—Bids are asked until 3 p. m., July 2, by the Park Board for furnishing all the labor and materials for reconstructing the roadway of the Eastern Boulevard, in Pelham Bay Park, including surfacing with asphaltic mixture, from the Split Rock road to the northern boundary of Pelham Bay Park, in the Borough of The Bronx. Henry Smith is Pres. Bd.

BROOKLYN, N. Y.—Bids are asked until July 1 by Bird S. Coler, Boro. Pres., for regulating and repaving with asphalt on a concrete foundation Smith St., from Fulton St. to Atlantic Ave. Engineer's estimate: 1,470 sq. yds. asphalt pavement, including binder course, outside of the railroad franchise area (5-yr. maintenance); 1,680 lin. ft. of new curb, furnished and set in concrete, etc.

*AUBURN, N. Y.—Bids are asked by C. August Koenig, Mayor, until 8 p. m., July 7, for paving William St. and Garden St. with standard asphalt and constructing subways in said streets. J. S. Hanlon is City Clk.

PORT CHESTER, N. Y.—The Board of Trustees on June 17 awarded the contract to the TERRALITHIC CO. for the Post Road improvement at $15,605.

*SILVER CREEK, N. Y.—Bids are asked until noon, June 29, by C. B. Livermore, Village Clk., for paving Main St.

*NEWBURGH, N. Y.—Bids are asked until 5 p. m., July 1, by D. J. Coutant, City Clk., for furnishing all materials, paving and permanently improving that portion of Liberty St. lying between South and North Sts. with vitrified block, asphalt block or Warren's bitulithic pavement. There is about 14,625 sq. yds. to be paved, curbstones to be set, catch-basins, etc., to be built.

LEWISTON, N. Y.—One bid was received by F. C. Stevens, Supt. Pub. Wks., Albany, on June 23 for the construction of about ½ mile of a public road across the Tuscarora Indian Reservation here, that of the Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., New York, at $5,377. This company already holds contract for building the remaining portion of this highway.

UTICA, N. Y.—The lowest bid opened June 2 by the Board of Contract and Supply for paving with asphalt portions of Walker, Water, St. Vincent, Arthur, Miller, James, West Burnet, Hubbell, Spring, Eagle and Caroline Sts. was submitted by the Barber Asphalt Paving Co., 131 Broad St., Utica, at $1.94 per sq. yd.

HOOSICK FALLS, N. Y.—The citizens have voted to appropriate $50,000 for paving and curbing the main streets of the village.

MT. KISCO, N. Y.—Bids were opened on June 8 by the Town Board of Bedford in the office of Joseph E. Merriam, Town Clk., at Mt. Kisco, for grading and improving a road a distance of about 3 1-3 miles, leading from the Cross River bridge to the Lewis Borough town line. The contract was awarded to JAMES GARAFANO, 39 South Third Ave., Mt. Vernon, N. Y. Byrne & Darling are Engrs.-in-Charge, White Plains, N. Y.

*SALEM, N. J.—Plans are on file at the office of Engineering News, New York, for the construction of the second section of the Alloway and Aldine road. Bids are asked until July 6.

*BLOOMFIELD, N. J.—We are officially advised that no bids were received on June 16 by William L. Johnson, Town Clk., for the estimate and specifications for the abatement of dust on certain telford roads.

FORT MOTT (Salem post-office), N. J.—Bids are asked until July 17 by Capt. J. L. Knowlton, Constructing Q. M., U. S. A., Fort Dupont, Delaware City, Del., for constructing an oyster shell road and drain for Flinn's Point National Cemetery at Fort Mott.

BENTLEYVILLE, Pa.—Bids are asked until 4 p. m., July 6, by C. C. Hanlon, Borough Engr., for 3,300 sq. yds. of paving and curbing.

ERIE, PA.—Bids are asked until June 29, by the Board of Public Works, for street paving. B. F. Briggs is City Engr.

HARRISBURG, PA.—The following bids were opened on June 1 by the State Highway Dept., Joseph W. Hunter, Comr., Harrisburg, for constructing (a) 14,680 ft. of road in Bristol Township, (b) 4,220 ft. in Hilltown, (c) 10,356 ft. in Hilltown, (d) 8,820 ft. in Langhorne, and (e) in Silverton: J. T. Shanley Co., Arcade Bldg., Philadelphia, (a) two bids) $28,196 and $28,276, (d) $20,621; Ambler-Davis Co., 14 South Broad St., Philadelphia, Pa., (a) $26,340, (b) $8,794, (c) $21,412; William McClellan, of Stratford, Pa., (a) two bids, $43,753 and $43,978; C. H. Bihlmaier, (b) $7,206, (c) $14,908, (e) $3,188; W. C. Evans, of Ambler, Pa., (b) two bids, $9,898 and $10,048, (c) two bids, $24,150 and $24,070, (e) $4,848; John S. Osterstock, of Easton, Pa., (b) $11,714, (c) $25,073; H. J. Schlimme & Co., of Philadelphia, (b) $9,415.

*SMETHPORT, PA.—The Borough Council on June 18 awarded the contract to the LOUIS GIPP CONSTRUCTION CO. for paving Main St., 12,447 yds. crete paving, at $27,35[illegible] noted on June 11. B. Secy.

SPRING CITY, PA.—B. B. Finkbiner, Council C for paving about 7,500 sq with vitrified brick.

McKEESPORT, PA.—B 4 p. m., July 8, by C troller, for the construct in East Park, Sixth War

WILKES-BARRE, PA.— til 2 p. m., July 6, by County Controller, for re Shavertown and Trucksv in Kingston and Dallas County.

BALTIMORE, MD.—The on June 17 awarded th WARREN BROS. CO. for from Payson St. to 12th S

*WASHINGTON, D. C. ers of the District of Colu to E. G. GUMMEL, 300 N. W., Washington, the c Massachusetts Ave. extend cu. yd.; and filling in Mo List of bidders noted last

WASHINGTON, D. C.—T ASPHALT BLOCK & TI awarded the contract, at South Carolina Ave. with The WARREN F. BR Washington, D. C., has contract for paving about trap rock at the sewage station, Washington, at 50

*WASHINGTON, D. C.— the Commissioners of the bia until noon, July 11, f streets with sheet asphalt laying asphalt block paven

PALATKA, FLA.—Bids July 21 by the city for 8,500 olithic sidewalk. J. E. Craig

CLEVELAND HEIGHTS (Cleveland post-office), OHIO.—Bids are asked until noon, July 7, by William G. Phare, Village Clk., 204 American Trust Bldg., Cleveland, for the improvement of part of Euclid Boulevard by grading, draining, sewering, paving with macadam and constructing sidewalks. F. A. Pease Engineering Co. are Engrs., 931 Williamson Bldg., Cleveland.

CHEVIOT, OHIO.—Bids are asked until noon, July 11, by Charles Crig, Village Clk., for the improvement of Applegate Ave.

CINCINNATI, OHIO.—The following contracts were awarded on June 12 by the Board of Public Service: For wood block in McMillan St., between Ohio and Clifton Aves., to the RUSSELL & JENNISON CO., $29,879; resurfacing with asphalt George St., between Elm and Mound Sts., the BARBER ASPHALT PAVING CO., First National Bank Bldg., Cincinnati, at $8,436. John J. Wenner is Clk. Bd.

CINCINNATI, OHIO.—Bids are asked until noon, July 17, by the County Commissioners for the improvement of Varner road and other roads. Fred Dreihs is Clk. Comrs.

CINCINNATI, OHIO.—Bids are asked until noon, July 10, by the Board of County Commissioners for the improvement of several roads and streets. Fred. Dreihs is Clk. Bd.

COLUMBUS, OHIO.—The following contracts were awarded by the Board of Public Service on June 12, for street improvements: Dennison Ave. to the river, D. E. SULLIVAN & SONS, $22,237; Yale Ave., State St. to Sullivan St., J. C. BEASLEY, $14,132.

HARTFORD CITY, IND.—The MODLIN BROS. have been awarded the contract by the County, at $6,450, for constructing the Hudson gravel road.

ASHTABULA, OHIO.—Bids are asked until 1 p. m., July 9, by the County Audr. for grading and macadamizing 2.07 miles of road in Conneaut Township.

ALLIANCE, OHIO.—Bids are asked until noon, July 3, by the Board of Public Service for grading and paving several streets. C. E. Swearingen is Clk. Bd.

MARTINSVILLE, IND.—Bids are asked until 2 p. m., July 7, by the Commissioners of Morgan County for the construction of several gravel roads. B. E. Thornbury is County Audr.

GREENSBURG, IND.—Bids are asked by the Commissioners of Decatur County until 1 p. m., July 6, for the construction of several gravel roads. Frank E. Ryan is County Audr.

BLOOMFIELD, IND.—Bids are asked by the Commissioners of Greene County until 2 p. m., July 7, for the construction of gravel roads.

PERU, IND.—SIDNEY A. VAUGH and JAMES WILBURN have been awarded contracts for constructing 23 miles of gravel road.

LINCOLN, ILL.—The Board of Local Improvements on June 10 awarded to GEORGE A. PETER, of Elgin, Ill., the contract for paving Delaven St., at $10,72[illegible]

*AURORA, ILL.—Bids are asked until 2 p. m., July 7, by the Board of Local Improvements for brick paving and combined curb and gutter. Myron J. Barble is City Engr.

CAIRO, ILL.—Plans, specifications and estimates have been completed for brick paving on 34th St. and are being prepared for similar work on 21st, Eighth and Walnut Sts. and St. Mary's Place West. W. B. Thistlewood is City Engr.

HAMPTON, IOWA.—Bids are asked until 8 p. m., July 6, by E. D. Hackler, City Clk., for the construction of approximately 15,000 sq. yds. of vitrified brick paving and 4,500 lin. ft. of concrete curb.

DAVENPORT, IOWA.—The McCARTHY IMPROVEMENT CO., of Davenport, has been awarded the contract by the Board of Public Works for paving Oak ley, Harris and other streets (bids opened June 21, about 19,754 sq. yds. of brick pav[illegible] at $1.49 p[illegible]

$1.59; 6,7[illegible] cu. yds. of excavation, 34 to 40 cts. per [illegible] yd.; and 10,601 lin. ft. of curb, 32 cts. per [illegible] ft.

The INDEPENDENT CONSTRUCTION CO., of [illegible]mport, has secured the contract for paving [illegible]inth St. with brick, 1,830 sq. yds., at $[illegible] 1,048 lin. ft. curb, 33 cts., and 600 cu. [illegible] of excavation, 38 cts. W. H. Claussen [illegible]k Bd.

ST. P[illegible] MINN.—Bids are asked until July 6 [illegible] Board of County Commissioners for [illegible]ving a portion of Bald Eagle Lake A[illegible] Edward G. Krahmer is County Audr.

FORT [illegible]AVENWORTH, KAN.—JAMES STAUN[illegible] has been awarded the contract, at $16.[illegible] grading Grant Ave. here.

OMAH[illegible] NEB.—Bids are asked until June 27, by [illegible]ark Board for paving a portion of Ed C[illegible]on Ave. with brick and artificial stone c[illegible]

ST. L[illegible] MO.—Bids are asked by the Board [illegible]blic Improvements until 10 a. m., July [illegible] for opening and widening several alleys. [illegible] Dryden is Secy. Bd.

SAN A[illegible]NIO, TEX.—Bids are asked until July [illegible] by Fred. Fries, City Clk., for construc[illegible] 21,000 sq. yds. of pavement on Houston [illegible] including space of street car tracks a[illegible] 7,000 lin. ft. of curbing. Bids will be [illegible]ved on vitrified brick, bitulithic, sheet as[illegible]t and rock asphalt.

SEATT[illegible] WASH.—Bids are asked until June 27, [illegible] C. B. Bagley, Secy. Bd. of Pub. Wks., for the following street improvements: Olive St[illegible]nd other streets, regrading, $50,400; 37th Ave. South, grading and concrete walks, $[illegible]40; Westlake Ave. North, wood walks, $[illegible]40; North and West 60th St., concrete walks, $5,600; Sixth Ave. North and other street, concrete sidewalks, $23,400; Mayfair Ave. and other street, concrete sidewalks, $14,000.

Bids are asked until July 3 by the Board of Pub. Serv. for street improvements as follows: Roy St. and other street, asphalt paving, $170,000; 16th Ave. North and other streets, same, $223,700; West Lee St. and other streets, same, $149,500; 21st Ave. and East Olive St., asphalt paving, $62,000; Eastlake Ave., same, $115,000.

SEATTLE, WASH.—We are officially advised that the following bids have been received by the Board of Public Works for the improvement of East Denny Way and other streets: Young & Urick, 204 Pioneer Bldg., Seattle, $26,995; H. F. Jahn & Co., Empire Bldg., Seattle, $27,838; T. RYAN, Sullivan Bldg., Seattle, $25,427 (awarded contract); S. Krogh, Seattle, $28,161; T. I. Peterson, Seattle, $26,862.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

HOLYOKE, MASS.—The Lyman Mills will erect big No. 5 mill this year, and the contract has been awarded to CASPAR RANGER, Appleton and Bond Sts., Holyoke. The mill will be 300 × 100 ft. and five stories in height. The foundation is of concrete, and was put in some months ago. The cost of the work is stated to be about $150,000.

*FORT ANDREWS (Boston post-office), MASS.—Capt. Ira L. Fredendall, Constr. Q. M., has let contract for construction of a bakery at this post to C. E. CURRIER, 110 Summer St., Boston, Mass., at $8,820.

CLINTON, MASS.—See under Light and Power Plants.

ROCHESTER, N. Y.—Plans have been prepared for a factory, 48 × 98 ft., for the American Candied Fruit Co., 20 Gertrude St., at the intersection of Blossom Road and the New York Central and Hudson River R. R. tracks. The building will be two stories in height and of reinforced concrete. It will be fireproof.

BUFFALO, N. Y.—Bids are asked until June 29, by the Star Plating Works, 61 Terrace St., Buffalo, for constructing a 2 and 3-story brick factory building, 24 × 140 ft., to cost $7,000, including equipment. Power elevators, electric motor, tanks, steam engine, etc., are needed. W. H. Zawadzki, 1123 Broadway, Buffalo, N. Y., is Arch.; M. J. Nowak is Gen. Mgr.

PHILADELPHIA, PA.—Plans for the erection of a packing plant at 30th and Arch Sts. for the West Philadelphia Stock Yards Co. have been posted for estimates in the offices of the Armstrong & Latta Co., Land Title Bldg., and the William Steele & Sons Co., 1000 Arch St. C. B. Comstock, East End Hotel, Pittsburg, is Arch. The building will be of brick, two stories high, and will measure 60 × 192 ft.

ERIE, PA.—The Erie Foundry Co., of Erie, Pa., manufacturer of steam hammers, punches, shears, rolling mill machinery and castings, will decide upon plans soon for rebuilding its plant, which was destroyed by fire recently.

RICHMOND, VA.—The Joseph Schlitz Brewing Co., of Milwaukee, Wis., will establish brewery in Richmond. The building will be 150 × 300 ft., two stories high. The first floor will contain bottling department and cold storage, second floor offices and the stable will be connected with building in rear, with ample trackage for loading and unloading cars.

HAPEVILLE, GA.—The Germofert Mfg. Co., W. B. Chisolm, Pres., Charleston, S. C., has awarded contract to I. F. LANIER, 116 Nassau St., Charleston, S. C., to erect buildings for fertilizer factory. Cost, about $200,000. The company has established an office in the Empire Building, Atlanta, Ga.

FORT DADE (Egmont post-office), FLA.—Bids will be received until July 16, by the Constructing Quartermaster at Fort Dade for constructing a distilling and ice plant.

KNOXVILLE, TENN.—The Roddy-Goodman Co., confectioners and bottlers, will enlarge its plant. A 3-story and basement building of mill construction will be erected, to cost $20,000. L. C. Waters, Pickle & Turner Bldg., is Arch.

COLUMBUS, OHIO.—The Hamilton Mfg. Co. will erect a factory building on East Fifth Ave. W. K. Field, Outlook Bldg., is Pres.; W. E. Hamilton is Gen. Mgr.

SALEM, OHIO.—Construction of the factory of the American Case & Register Co. will be started at once. The factory will be erected by the CUYAHOGA CONCRETE STONE CO., 2561 East 89th St., Cleveland, Ohio.

CLEVELAND, OHIO.—The McGeorge Engineering Co., Century Bldg., Cleveland, advise us that the building for the Peerless Motor Car Co. will be approximately 106 ft. wide and 144 ft. long, and is to be of brick, steel and reinforced-concrete construction. The second floor will consist of a gallery 30 ft. wide, running around the four sides of the building, the center portion being open up to the roof. This center portion will be covered with a skylight about 35 ft. wide. Contracts have been awarded at the following approximate figures: GRIESE & WALKER, Cleveland, Ohio, general contract, $19,000; MASTERS & MULLEN CONSTRUCTION CO., Rose Bldg., Cleveland, reinforced-concrete floor, $4,000; THE INTERSTATE ENGINEERING CO., Bedford, Ohio, structural steel, $5,000; DEWSTOE & BRAINARD, 2076 East 22d St., Cleveland, plumbing and sewering, $2,000. Total, about $30,000.

SPRINGFIELD, OHIO.—The EILENBERGER CONSTRUCTION CO., 153 La Salle St., Chicago, has been awarded the contract by the American Seeding Machine Co. for three buildings which are to be erected this summer at Monroe and Linden Aves. It is planned to begin razing the foundry at the point mentioned at once. A 3-story factory will be built at the corner of Monroe and Linden Aves. Next to it will be the foundry one story in height and adjoining it will be a 2-story storage building. The total cost of the three buildings will be between $50,000 and $60,000.

MARIETTA, OHIO.—The contract for the construction of the proposed plant of the Marietta Paint & Color Co., which is to be built in Norwood, has been let to THOMAS HADLEY and A. H. SMITH. It is stated that the new plant will cost over $10,000. Four buildings are to be erected. One of these will be a long 2-story structure, which will be the main building. A 1-story building, of the same dimensions, will be used for the mixing room, etc. Besides these, there will be an office building and smaller structure.

CINCINNATI, OHIO.—The Pfau Mfg. Co., 538 Reading Road, intends to erect a factory on Langdon Ave., Idlewild, to cost $50,000.

NORWOOD (Cincinnati post-office), OHIO.—R. P. Harkness advises us that the contract for constructing a 4-story L-shaped building for the U. S. Printing Co. in Norwood, has been awarded to the FERRO CONCRETE CONSTRUCTION CO., Richmond and Harriet Sts., Cincinnati. Samuel Hanaford & Sons, Hulbert Block, Cincinnati, are Archs.

GREAT FALLS, MONT.—We are advised that the Great Falls Iron Works is to erect a machine shop of brick and steel construction, two stories high, 60 × 80 ft., and to cost about $10,000.

EL RENO, OKLA.—The Canace Mfg. Co., of Centralia, Mo., manufacturers of electrical appliances, will build a 2-story brick factory here, 50 × 100 ft., to cost $10,000.

WAURIKA, OKLA.—P. A. Fitzhugh, of Clinton, La., will erect a cotton seed oil mill here to cost $100,000. A site has been selected and work will begin soon.

SPOKANE, WASH.—The Fidelity Lumber Co. has purchased a site upon which to erect a planing mill and sash and door factory.

PORTLAND, ORE.—The packing plant of the National Packing Co., at East Second and Star Sts., which recently was destroyed by fire, causing a loss of $25,000, will be rebuilt at once.

FERNIE, B. C.—The Fernie-Fort Steele Brewing Co. have awarded the contract for the erection of a $200,000 brewing plant to H. STANLEY, of this town.

PHOENIX, B. C.—The plant of the Phoenix Brewing Co. is to be enlarged to treble its present capacity. The new building will be 40 × 20 ft., three stories high.

MISCELLANEOUS CONTRACTS.

(denotes that this work is advertised in Engineering News.)*

U. S. RECLAMATION SERVICE.—All news relative to canal projects, etc., will be found under Water Supply—Irrigation.

SUBWAY.—Oakland, Cal.—See under Light and Power Plants.

CONDUIT.—Sioux City, Iowa.—Preliminary plans have been made for construction of the Bacon Creek diverting conduit. G. Y. Skeels, City Engr.

*DREDGING.—Mobile, Ala.—Bids are asked until 11 a. m., July 20, by Maj. H. Jervey, Corps Engrs., U. S. A., for dredging the mouth of the Pascagoula River, Miss.

GUN CARRIAGES.—Washington, D. C.—Bids are asked until July 6 at the Army Ordnance Office for furnishing two 12-in. disappearing gun carriages, L. F., Model 1901.

SUBWAY.—Ashtabula, Ohio.—Subway will be built at Lake St. by the city of Ashtabula and the Lake Shore & Michigan Southern Ry. Co. Estimated cost, $102,000. L. A. Amsden is City Engr.

*DREDGING.—Newport, R. I.—Bids are asked until 2 p. m., July 22, by Maj. Harry Taylor, Corps Engrs., U. S. A., Newport, for dredging and removing rock from the Pawtucket River, R. I.

VESSELS.—Washington, D. C.—The Quartermaster-General, U. S. A., Washington, D. C., has awarded contracts as follows for launches: For four gasoline launches to the MATTHEWS BOAT CO., Port Clinton, Ohio, $53,600; and for three steam launches to the RACINE BOAT CO., Muskegon, Mich., at $45,600.

*DREDGING.—Detroit, Mich.—Bids are asked by Lt.-Col. C. McD. Townsend, Corps Engrs., U. S. A., until 3 p. m., July 21, for dredging Hay Lake and Neebish Channels, St. Marys River, Mich.

*DAM GATES.—Wheeling, W. Va.—Bids are asked until 11 a. m., July 9, by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., for constructing and erecting steel gates for locks at Dams Nos. 18 and 13, Ohio River.

*REMOVING ROCK.—New York, N. Y.—Bids are asked until noon, July 17, by Col. John G. D. Knight, Corps Engrs., U. S. A., for removing Long Rock in Harbor at Echo Bay, N. Y., and ledge rock in Bronx River, N. Y.

DITCH.—St. Paul, Minn.—Contract has been awarded to A. F. DOYLE, St. Cloud, Minn., at $31,000 for construction of a ditch to run through St. Louis, Aitkin and Itasca counties. Geo. A. Ralph, St. Paul, State Drainage Engr.

*INLAND WATERWAY.—Wilmington, N. C.—Bids are asked until noon, July 27, by Capt. Earl I. Brown, Corps Engrs., U. S. A., Wilmington, for constructing an inland waterway from Pamlico Sound to Beaufort Inlet, S. C.

DITCHES.—Jackson, Minn.—The contract for constructing drainage ditches here has been awarded to the DRAINAGE CONSTRUCTION CO., 710 Globe Bldg., St. Paul, Minn. Cost, $22,000. P. D. McKellar, County Audr.

*TIMBER.—Detroit, Mich.—Bids are asked by Lt.-Col. C. McD. Townsend, Corps Engrs., U. S. A., until 3 p. m., July 17, for furnishing and delivering at St. Marys Falls Canal, Michigan, about 1,328,000 ft. B. M. of Hemlock timber.

GASOLINE ENGINES.—New York, N. Y.—Bids are asked by Theo. A. Bingham, Police Comr., until 10 a. m., July 3, for installing gasoline engines with tanks and full equipment in Launches 3, 4 and 5 of the Police Dept., New York.

*IMPROVING CHANNELS.—Des Moines, Iowa.—Bids are asked until 11 a. m., July 15, by the City Council, for improving the channels of the Raccoon and Des Moines Rivers. A. J. Mathis is Mayor; George D. Dobson is City Engr.

*TIMBER PIERS.—Charleston, S. C.—Bids are asked until 11 a. m., July 25, by R. C. Hollyday, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing timber piers for torpedo boats at the Navy Yard, Charleston.

*SUBMERGED OUTLETS.—Boston, Mass.—Bids are asked until 2.30 p. m., July 7, by the Charles River Basin Comn., 367 Boylston St., Boston, for constructing five timber submerged outlets for the Boston Marginal Conduit. Hiram A. Miller is Ch. Engr.

GUN FORGINGS.—Washington, D. C.—Bids are asked by N. E. Mason, Ch. of Bureau of Ordnance, Navy Dept., Washington, until noon, July 8, for furnishing 16 sets 12-in., 8 sets 8-in., 25 sets 6-in. and 104 sets 3-in. nickel steel gun forgings.

RETAINING WALL.—Massillon, Ohio.—Bids were received on June 8 by the Board of Public Service, G. G. Paul, Clk., for building riprap retaining wall. Contract was awarded to WM. H. VOGT & SONS, Massillon, at $3.97½ per perch. Estimated cost, $2,000.

AIR COMPRESSOR.—Bremerton, Wash.—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded to the LAIDLAW-DUNN-GORDON CO., 115 Broadway, New York, contract for furnishing one 5,000-HP. cross-compound Corliss air compressor at $27,100.

*LIGHT-HOUSE SUPERSTRUCTURE.—Wilmington, Del.—Bids are asked by the Light-House Engineer, Wilmington, Del., until 11 a. m., July 10, for furnishing the metalwork for the superstructure of the light-house at Elbow of Cross Ledge Light-Station, Delaware Bay, N. J.

DITCH.—Glenwood, Minn.—Bids are asked until 10 a. m., July 7, by the County Auditor, for digging and constructing Judicial Ditch No. 1, Pape and Stearns Counties. Approximate quantities and estimated cost are on file at office of Engineering News, New York. Morgan & Wilson, Engrs.

*QUAY WALL, PIER, ETC.—Key West, Fla.—Bids are asked until 11 a. m., Aug. 1, by R. C. Hollyday, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a steel and concrete quay wall and pier on timber piles, and a steel and concrete coal shed at the naval station, Key West, Fla.

SHORE PROTECTION.—Toronto, Ont.—MILLER & CUMMING, 50 Front St. East, Toronto, have contract for building timber cribs and concrete superstructure on Toronto Island at $45,000. Contractors have complete plant except one derrick and one mixer. J. G. Sing is Engr., Confederation Life Bldg., Toronto.

WALLS, PIERS, ETC.—New York, N. Y.—Bids are asked by Henry Smith, Pres. Park Board, until 3 p. m., July 2, for erecting and constructing the concrete wall, piers and footing and reinforced concrete posts, surmounted by an electrically welded iron fence, on the eastern extension of Bronx Park, in the City of New York.

*RETAINING WALL.—Wilmington, Del.—Bids are asked by Edward R. Mack, Park Engr., until 10.30 a. m., July 2, for constructing a reinforced concrete retaining wall, 276 ft. long, along Brandywine Creek at Kirkwood Park, Wilmington. Plans and specifications are on file at office of Engineering News, New York.

DITCH.—Urbana, Ohio.—Bids are asked by C. S. Pratt, County Surv., Urbana, until 10 a. m., June 27, for constructing the Kenaga Ditch. The work is divided into seven sections, and includes 43,049 cu. yds. open excavation, the placing of 470 ft. of 20-in. tile, construction of one filter, and two concrete retaining walls. The estimated cost of the whole work is $10,002, and the ditch is to be completed Dec. 31, 1908.

DERRICK.—Bremerton, Wash.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., July 11, for one 100-ton floating derrick having a 5-ton auxiliary hoist, at the Puget Sound Navy Yard, Bremerton. R. C. Hollyday, Ch. of Bureau. Specifications are on file at the office of Engineering News, New York.

*POST-OFFICE LOCK BOXES.—Washington, D. C.—Bids are asked until 3 p. m., July 6, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, for furnishing and delivering post-office lock boxes, etc., as they may be ordered for post-offices in public buildings under control of the Treasury Department during the fiscal year ending June 30, 1909.

PROTECTION WALL.—Skaneateles, N. Y.—The bids received on June 23 by F. C. Stevens, Supt. Public Works, for the work of constructing protection wall on west side of Skaneateles Lake Outlet at Skaneateles, N. Y., were: Young & Cawbrey, Syracuse, N. Y., $11,983; Henry Tosh & Sons, Port Byron, N. Y., $13,469. Frederick Skene is State Engr. and Surv.

*CREEK IMPROVEMENT.—Syracuse, N. Y.—Bids are asked until 4 p. m., July 23, by Henry J. Hamlin, Secy. Syracuse Intercepting Sewer Board, 112 Court House, Syracuse, for improving Onondaga Creek. The work covers approximately 2⅝ miles in length. Its principal items are 76,000 cu. yds. excavation and 14,800 cu. yds. concrete blocks and mass concrete.

PROJECTILES.—Washington, D. C.—The Chief of Army Ordnance, Washington, has awarded contracts as follows for furnishing projectiles: The RICHMOND IRON WORKS, Richmond, Va., 20,000 2.95-in. cast-iron shot for sub-caliber guns, 98½ cts. each. The TREDEGAR CO., Richmond, Va., 1,000 ten-inch rifle cast-iron shell, $18.25 each; 300 12-in. same, $25.95 each; 2,000 12-in. mortar cast-iron shell, $24.95 each.

ROCK.—New Orleans, La.—Bids were received June 6, by Maj. J. F. McIndoe, Corps Engrs., U. S. A., 1539 Louisiana Ave., for (a) furnishing about 10,000 tons rock at points on Mississippi River below Vicksburg, Miss.; (b) for furnishing about 10,000 tons rock for New Orleans Harbor. The bids recommended to the Chief of Engineers, U. S. A., for acceptance were: Guy Dickinson, Little Rock, Ark., $2.25 on barges at Vidalia, La.; F. A. Daniels, New Orleans, $2 on barges in New Orleans Harbor.

CABLE.—Washington, D. C.—Bids were received June 15 by the Chief Signal Officer U. S. Army, for furnishing cable as follows: Item 1, 20 miles, Type 44, intermediate single conductor cable, Specification 419; Item 2, 30 miles, Type 45, intermediate single conductor cable; Item 3, 40 light double armored single conductor cable, Specification 421. The Okonite Co., Postal Bldg., New York, (1) $1,093 per mile; (2) $904; (3) $1,770; total, $57,430. Time, 150 days. Safety Insulated Wire & Cable Co., 114 Liberty St., New York, (1) $570; (2) $450; (3) $1,078; total, $30,280. Time, 45 days.

*BARGE CANAL.—Albany, N. Y.—Bids are asked until noon, July 21, by F. C. Stevens, Supt. Public Works, State of New York, Capitol Bldg., Albany, for improving New York State Canals as follows: Contract 60, Erie Canal, Section 9—For the improvement of the Erie Canal from the west end of Contract No. 6 to about one-half mile west of Adams Basin bridge. Length, 8.53 miles.

Contract 64, Erie Canal, Section 10—For the improvement of the Erie Canal from 600 ft. west of Prospect St. bridge, Medina, to 100 ft. east of Gasport bridge. Lengh, 9.91 miles.

For other Proposal Advertisements see pages 43, 44, 45, 47, 51, of Advertisements and Construction News page 224.

CANAL WORK.

STATE OF NEW YORK.
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.
Albany, June 22, 1908.
NOTICE TO CONTRACTORS.

Sealed proposals will be received by the undersigned at his office in the Capitol in Albany, N. Y., until twelve o'clock noon of Tuesday, July 21st, 1908, at which place and hour they will be publicly opened and read, for improving the New York State Canals, pursuant to the provisions of chapter 147 of the Laws of 1903, and of the amendments thereto, as follows:

1.
CONTRACT NO. 60.
Erie Canal. Section 9.

For the improvement of the Erie canal from the west end of Contract No. 6 to about one-half mile west of Adams Basin bridge. Length, 8.53 miles. Sheets 1 to 58, inclusive.

2.
CONTRACT NO. 64.
Erie Canal. Section 10.

For the improvement of the Erie canal from 600 feet west of Prospect Street Bridge, Medina, to 100 feet east of Gasport Bridge. Length, 9.91 miles. Sheets 1 to 65, inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintend-

ent of Public Works, at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y.; and at the Canal Office, Spaulding's Exchange, Buffalo, N. Y. Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or State bank in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal. Upon execution of the contract and approval of bonds, the deposit will be returned to the proposer. The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be twenty-five per centum (25 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render informal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

F. C. STEVENS,
Superintendent of Public Works.

PAVING.

Omaha, June 22, 1908.

Notice is hereby given that the County Judge will receive bids for the paving of 4 miles, more or less, on Dodge Street Road, from the west end of pavement to crossing of Union Pacific R. R.; 2½ miles, more or less on Road 24-B, from Benson west; 1 mile, more or less, on Road 49-B; 4 miles, more or less, on Military Road; 2 miles, more or less, on lower Irvington Bennington Road; 2 miles, more or less, on Q Street Road; 2 miles, more or less, on Gifford Road, from Q Street Road to Centre Street Road; 4 miles, more or less, on Dodge Street Road, from crossing of Union Pacific R. R. to Elkhorn.

Said paving to be done under the Inheritance tax law, according to plans and specifications prepared by the County Surveyor, and on file in the office of the County Clerk.

Bids to be received up to and until 12 o'clock (noon) on Saturday, July 18th, 1907, and opened on that date.

Each bid to be accompanied by a certified check for $500, as evidence of good faith.

Work to be completed by December 1st, 1908.

The County Board reserves the right to reject any or all bids.

D. M. HAVERLY,
County Clerk.

U. S. ENGINEER OFFICE, Wilmington, N. C., June 25th, 1908.—Sealed proposals for constructing Inland Waterway from Pamlico Sound to Beaufort Inlet, N. C., will be received here until 12 o'clock, noon, July 27, 1908. Information on application. EARL I. BROWN, Capt., Engrs.

PIPE AND SPECIALS.

Pensacola, Fla.

Sealed proposals will be received by the Board of Bond Trustees, Pensacola, Fla., at its office in the City Hall, up to 12 o'clock noon, July 1st, 1908, for furnishing and delivering either f. o. b. cars or on wharf at Pensacola, Fla., 624 feet of 16-inch cast-iron pipe, 3,048 feet of 12-inch, 18,576 feet 10-inch, and 756 feet of 4-inch, weighing approximately 855 tons, with about 22 tons of special castings. Also one 16-inch gate valve, 6 12-inch, 17 10-inch, 26 6-inch and 1 4-inch and 31 two-way fire hydrants with steamer nozzle and 51 cast-iron extension valve boxes.

A certified check will be required to accompany each bid. That for the cast-iron pipe must be $1,000 and for the valves and hydrants $200, check to be made payable to the Board of Bond Trustees.

The right is reserved to reject any or all bids.

By order of the Board of Bond Trustees.

R. M. BUSHNELL,
Chairman.

T. CHALKLEY HATTON,
Chief Engineer.

CAST IRON PIPE AND SPECIAL CASTINGS.

Manchester, Mass.

Sealed proposals will be received by the Board of Water Commissioners of the Town of Manchester, Massachusetts, at its office in the Town Hall Building, Manchester, up to eight o'clock P. M., July 10, 1908, and then publicly opened and read, for furnishing and delivering, f. o. b. cars, at Manchester, Massachusetts, or Beverly Farms, Massachusetts, about four hundred and forty-three (443) net tons sixteen (16) inch straight bell and spigot, coated cast iron pipe, Class E, New England Water Works Assn. Standard, weighing 1,610 pounds per length of twelve feet; about five hundred and twenty-three (523) net tons fourteen (14) inch straight bell and spigot coated cast iron pipe, Class E, New England Water Works Assn. Standard, weighing 1,310 pounds per length of twelve feet; and about twelve (12) tons of special castings. All pipe and specials to be in accordance with the specifications of the said New England Water Works Association.

Proposal blanks, together with complete specifications can be obtained from Raymond C. Allen, Manchester, Mass., Engineer.

Each proposal must be accompanied by a certified check for $1,000, payable to the Board of Water Commissioners of the Town of Manchester.

Should any bid be rejected, such check shall be forthwith returned to the bidder, and should any bid be accepted, such check shall be returned upon the proper execution and securing of the contract.

The Board of Water Commissioners reserves the right to reject any or all bids, if the best interest of the Town of Manchester may thereby be conserved.

FREDERICK J. MERRILL,
Chairman, Water Commission.
RAYMOND C. ALLEN,
Engineer.

SEWAGE DISPOSAL PLANT.

Wadsworth, Ohio.

Sealed bids will be received by the Council of the Village of Wadsworth, Ohio, at the Office of the Village Clerk, until twelve (12) o'clock noon on July 6th, A. D. 1908, for the furnishing of the necessary labor and materials for the Construction of a Sewerage Disposal Plant, in accordance with plans and specifications now on file in the Office of the Village Clerk of Wadsworth, Ohio. Each bid must contain the full name of every person and company interested in the same and must be accompanied by cash or certified check on some reliable Bank in the Sum of Three Hundred and Fifty ($350.00) Dollars as a guarantee that if the bid is accepted a Contract will be entered into and its performance properly secured; should any bid be rejected such check will be returned upon the proper execution and securement of the Contract.

Bidders will be required to use the printed forms which will be furnished upon application.

The right is reserved to accept or reject any or all bids.

By order of the Village Council.

LOUIS F. ALLEN,
Village Clerk.

Wadsworth, Ohio, June 9th, 1908.

SEWER.

OFFICE OF THE COMMISSIONERS OF SEWERAGE OF LOUISVILLE.
Incorporated.

Sealed proposals for the construction of a sewer known as Section "B" of the Twenty-fifth Street Sewer, Contract No. 9 of the Comprehensive of Sewerage for the City of Louisville, Kentucky, will be received at the office of the Commissioners of Sewerage until 12 o'clock noon, July 17th, 1908.

This work consists mainly of a circular sewer constructed of concrete (or brick) masonry and pipe as follows: 2,074 feet concrete, 5'-2" in diameter; 1,065 ft. concrete, 4'-4" in diameter; 630 ft. concrete, 45" in diameter; 503 ft. concrete, 39" in diameter; 403 ft. concrete, 30" in diameter; 190 ft. pipe, 18" in diameter.

The principal items in the Engineer's estimate of the work are approximately as follows:

Excavation, Depth of cut 20 ft. to 8 ft. ..... 4,865 linear feet
Concrete (or brick) masonry 1,650 cubic yards

Plans and specifications may be seen at the office of the Commissioners and at the office of the Consulting Engineer, Harrison P. Eddy, of Metcalf & Eddy, 14 Beacon St., Boston, Mass.

Sealed bids should be endorsed "Proposals for Section 'B' of the Twenty-fifth Street Sewer," and addressed to the Commissioners of Sewerage, 603, 605 and 607 Equitable Building, Louisville, Ky. Each bid shall be accompanied by a certified check for at least seven per cent. (7%) of the total amount of the bid or a "Bidder's Bond" as described in the form of proposal.

P. L. ATHERTON,
Chairman.

CHAS. P. WEAVER,
Secy. and Treas.
J. B. F. BREED,
Chief Engineer.

EARTH AND CONCRETE DAM.

Traverse City, Mich.

Sealed proposals will be received until 2 P. M., July 15th, by the Boardman River Electric Light & Power Company, at Traverse City, Michigan, for raising their "Upper Dam" from its present head of 22 feet to a head of 41 feet.

The approximate quantities are as follows:

Earth excavation, wet..... 2,500 cu. yds.
Earth embankment..... 90,000 cu. yds.
Concrete—mostly reinforced... 5,000 cu. yds.

Plans may be seen after June 30th at the office of Engineering News, Chicago, Ill.; Office of Wm. G. Fargo, Jackson, Mich., and at Traverse City.

SUBMERGED OUTLETS.

COMMONWEALTH OF MASSACHUSETTS.
CHARLES RIVER BASIN COMMISSION.

Sealed proposals will be received at the office of the Charles River Basin Commission, 367 Boylston Street, Boston, Mass., until 2.30 o'clock p. m., of Tuesday, July 7, 1908, for constructing five timber submerged outlets for the Boston Marginal Conduit in the city of Boston, Mass. These outlets are to be five feet and six feet square, each about one hundred feet long, and are to be supported on piles. Pamphlets containing further information for bidders, forms of proposal, contract and specifications will be mailed to contractors who apply to the Chief Engineer, or may be obtained at his office, 367 Boylston Street, Boston, where also plans may be seen. The printed form must be used in making proposals. The Commission reserves the right to reject any or all proposals and to accept the proposal deemed best for the Commonwealth. HENRY D. YERXA, Chairman, JOSHUA B. HOLDEN, EDGAR R. CHAMPLIN, Charles River Basin Commission; HIRAM A. MILLER, Chief Engineer; WILLIAM S. YOUNGMAN, Secretary.

STREET PAVING.

Lawrence, Mass.

Sealed proposals will be received at the office of City Clerk of the City of Lawrence, Mass., until 3 o'clock P. M. of Wednesday, July 8th, 1908, for 28,000 square yards, more or less, of street paving with wooden blocks on concrete base.

Plans and specifications may be seen at the office of the City Engineer, City Hall.

A. D. MARBLE,
City Engineer.

C. J. CORCORAN,
City Clerk.

BOND SALE.

32,000 SIX PER CENT. WATER-WORKS BONDS OF THE CITY OF MINOT, N. D.

The city of Minot is about to issue $32,000 of 6 per cent. 20-year water works bonds to be issued pursuant to a special election duly called and authorizing the issuance of said bonds, under Section [illegible] of the Revised Codes of North Dakota for [illegible]. Such bonds to be sold at not less than par.

Sealed bids will be received by the undersigned until 8 o'clock p. m. of the 13th day of July, A. D. 1908, for the purchase of said bonds. Said bonds to be in denominations of One Thousand dollars each.

The right is hereby reserved to reject any and all bids.

All bids to be accompanied by a certified check for Five Hundred Dollars to be payable to the City Treasurer of Minot, to be forfeited to said city of Minot, if bidder neglects or refuses to accept said bid according to the bid made by him.

Dated this 17th day of [illegible] A. D. 1908.

G. L. [illegible]ROW,
City Auditor.

LIGHT AND WATER WORKS PLANT.

Sturgeon Bay, Wis.

Notice is hereby given that sealed proposals will be received by the City Clerk of the City of Sturgeon Bay, Wis., at his office until 8 o'clock p. m., July 7, 1908, for the construction of an electric light and water-works plant as follows:

Bids will be received for furnishing materials and constructing the plant complete, also separate bids for machinery and material delivered f. o. b. cars Sturgeon Bay, Wis.

Tenders will also be received for the old machinery now in use in the city electric light plant.

Plans and specifications are on file and may be seen at the office of the City Clerk, also at the office of A. T. Maltby, 903 Great Northern Building, Chicago, Ill. Instructions to bidders will be furnished upon request.

By order of the Council, June 18, 1908.

H. C. LEONHARDT,
City Clerk.

PAVING.

Jamestown, New York.

Sealed proposals will be received by the Board of Estimate and Review, of the City of Jamestown, N. Y., until three o'clock p. m., June 29, 1908, for paving with brick block, 43,000 square yards and curbing with stone curb 22,000 lineal feet and 13,000 cubic yards of excavation.

Plans and specifications may be examined at the office of the City Engineer, where blank forms of proposals may be procured. A certified check in the sum of $2,000 will be required to accompany each bid. The right is reserved to reject any or all bids.

Signed.

W. I. BLYSTONE,
C. G. JONES,
JOHN A. LEE,
Board of Estimate and Review.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., June 22, 1908.—Sealed proposals will be received at this office until 2 o'clock P. M. on the 6th day of July, 1908, and then opened, for furnishing and delivering Post Office Lock Boxes, etc., as they may be ordered for Post Offices in Public Buildings under control of the Treasury Department, during the fiscal year ending June 30th, 1909, in accordance with drawing and specification, copies of which may be had at the discretion of the Supervising Architect by applying to this office. JAMES KNOX TAYLOR, Supervising Architect.

NOTICE

Proposals for Extension of Filtration Works, Pittsburg, Pa.

We are advised that the amount of bond mentioned in paragraph III of advertisement for proposals for the extension of filtration works, Pittsburg, should read "Two hundred and fifty thousand dollars ($250,000)," instead of $200,000, as appearing in advertisement on page 45. Plans and specifications for this work are on file at the office of Engineering News, New York.

Situations Open

ESTIMATOR; man to take off quantities and make up estimates on structural and ornamental iron work. Address THEODORE WESTING CO., 419 West 41st St., New York City. 26-tf

WANTED—An engineer with $5,000 to connect with a steel construction firm in New York. Big contract on hand. A good chance for one meaning business. Address "C. A. 26," Engineering News, New York. 26-tf